

1 Information and training packages would be  
2 available for the plants to use to get ready for the  
3 fall visual inspections.

4 Flaw evaluation guidelines are a longer  
5 term thing. It is to help us figure out how to long  
6 term manage this thing, but we are working on that  
7 right now also in case somebody does find something in  
8 the fall. You know, is there something that could be  
9 acceptable?

10 Review of repair and mitigation strategies  
11 is more of a long term thing. How do we wrap it up  
12 long term?

13 DR. KRESS: I'd like to return back to  
14 Dana's question for just a moment, the question of the  
15 potential that you won't SCRAM. Let's presume you  
16 break one of the control rod drive tube rods over near  
17 the periphery, and you suddenly have high pressure  
18 water and steam injected at sonic velocity and  
19 flashing as it comes out of that into this region  
20 where you have a cover over it and perhaps leak past,  
21 but the potential for building up pressure on one  
22 side, putting a torque on this head, perhaps creating  
23 a bending stress that might bend the other tubes to  
24 the extent that maybe one or two nearby won't be able  
25 to insert the rods again.

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1 I think that's what Dana had in mind. The  
2 question is has that been looked at an analyzed from  
3 the standpoint of what the stresses actually are and  
4 whether there would be a bend?

5 MR. MATTHEWS: Those are -- Excuse me. I  
6 didn't mean to interrupt. The consequential damages  
7 are part of what we will have to factor into the risk  
8 assessment when we are pulling this whole thing  
9 together.

10 These are very hefty tubes, like I said,  
11 and you don't have to go very far away from a small  
12 ejection until the pressure drops off very rapidly.  
13 When it is hitting a round surface, you know, you've  
14 got an even lower force --

15 DR. WALLIS: Drops off because you have  
16 already blown out the shroud or something?

17 MR. MATTHEWS: No, I'm just talking about  
18 if you break a pipe. You don't have to go very far  
19 away from that --

20 DR. WALLIS: No, but it goes into a  
21 volume.

22 DR. KRESS: Yes, and it's pressurizing the  
23 volume.

24 MR. MATTHEWS: Well, if it pressurizes the  
25 volume, then you don't have the differential across it

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1 to bend it.

2 MR. SIEBER: I think the volume you are  
3 talking about is the volume of the shield cover, which  
4 is pretty flimsy. You can't pressurize that.

5 MR. MATTHEWS: I depends. It may be an  
6 inch thick. I'm not sure. It depends -- Plants vary  
7 on how thick that thing is, and it's not air-tight.  
8 I'm not even sure what is on top of it. It may  
9 actually just blow right up through there. I'm not  
10 sure. It's not --

11 DR. KRESS: I think that is the problem  
12 Dana had in mind there.

13 MR. MATTHEWS: You have large openings in  
14 there for ventilation. Those CRDMs have to be kept  
15 cool. So those openings and fans and air ducts -- the  
16 main reason you have the shroud is for an air duct.

17 MR. ROSEN: You may find that when you do  
18 the analysis that the pressure differential -- If you  
19 do a transient and pressure differential analysis --  
20 never, never reaches very high pressure in that area.

21 MR. MATTHEWS: Across the --

22 MR. ROSEN: It vents in a lot of different  
23 directions.

24 MR. MATTHEWS: Yes.

25 DR. KRESS: I think that's the likely

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1 result, yes. So you wouldn't have a bending torque on  
2 it.

3 MR. ROSEN: Exactly. As he said, it is  
4 intended to be a lot of ventilation in that area  
5 because of the heat. It's naturally going to be  
6 venting.

7 MR. MATTHEWS: The insulation packages  
8 that it is venting into -- you know, those are just --  
9 they are light weight mirror insulation or they are  
10 blankets or stuff like that. It's not a sealed-up  
11 area.

12 DR. WALLIS: -- constant for thermal  
13 distortion by heating up one side to 600 degrees when  
14 the other side is cold is fairly long. So you think  
15 that distortion won't happen until you have SCRAMed  
16 and everything is fine?

17 DR. BONACA: Still, I mean, one thing that  
18 is important to note is that the ejection accident by  
19 the expectation of the FSAR is not a  $10^{-3}$  event. It's  
20 supposed to be a much more unlikely event than that,  
21 and that the most severe case is the zero power case  
22 where you essentially eject the rod, and you create  
23 that by having an effective SCRAM.

24 I mean, you have one rod out, and the rest  
25 comes in. Shut down the reactor, and you have the

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1 highest worth out, just because -- and you are  
2 blocking core. So I mean, it's not an issue that can  
3 be downplayed. I think it has to be evaluated,  
4 because it has significance.

5 CHAIRMAN FORD: I would like to open up  
6 the meeting to the subcommittee for any last minute  
7 questions. What I plan on doing is stopping at around  
8 about 11:30 for lunch until 12:15. We'll cut 15  
9 minutes off lunch, and then we will go straight into  
10 the NRR presentation.

11 So any last minute -- Graham?

12 MR. LEITCH: I would like to hear a little  
13 more about the nondestructive examination that is  
14 being contemplated. I guess I see, first of all,  
15 what's been done so far is a visual examination on top  
16 of the head. I notice from the pictures there were  
17 some dye penetrant examination beneath the head.

18 What is contemplated? Is this an  
19 ultrasonic demonstration? What are we talking about?  
20 PT? UT?

21 MR. MATTHEWS: From an under-the-head  
22 standpoint, you really want to do as much of this  
23 robotically as you can, because it's a very high dose  
24 -- very high dose environment.

25 In the early Nineties technology was

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1 developed for examining the ID surface of the  
2 penetrations, and that technology was an eddy current  
3 probe that examined the ID surface looking for ID  
4 connected flaws. If anything was found, UT technology  
5 was available to go in and size those flaws.

6 It was all geared toward ID connected  
7 flaws, because that's the dominant thing we had seen  
8 at that point in time. There were -- In the mock-ups  
9 and the demonstrations that were done in the early  
10 Nineties or mid-Nineties, there were circ flaws on the  
11 ID of the nozzle. Looking for those also, but we  
12 didn't have any OD initiated flaws in the mock-up.

13 So, basically, we don't have any qualified  
14 techniques for looking for this kind of situation. We  
15 are working to get mock-ups built. We are working to  
16 develop the techniques.

17 Primarily, the only way we can query that  
18 volume right now is a UT examination for the tube.  
19 Some vendors are saying they are developing eddy  
20 currents for looking at the OD of the tube below the  
21 weld for the OD -- or looking at the weld material  
22 itself for connected flaws there. They haven't been  
23 demonstrated. We are working to try and get those  
24 things set up and see if those technologies are  
25 available.

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1           The plants that are going to be doing any  
2 kind of volumetric exams -- it would be --  
3 Westinghouse plants have an interfering -- and I'm not  
4 sure about the CE. They have an interfering thermal  
5 sleeve. So they only have a gap, a small gap between  
6 the ID of the penetration and the OD of this thermal  
7 sleeve. So anything delivered to the ID of the  
8 penetration has to be on a kind of a saber, and it's  
9 a saber that is rastered back and forth around the  
10 thing, looking for eddy current, the primary  
11 technology.

12           Now we are talking about putting UT probes  
13 on there and trying to detect flaws anywhere in the  
14 tube, ID or OD. It takes longer, and it takes a  
15 different set of transducer packages.

16           It depends on whether you are looking  
17 axially or circumferentially, and that stuff is being  
18 worked on by the inspection committee and by the EPRI  
19 and DE center to try and build these mock-ups and work  
20 with the vendors, who are themselves working on the  
21 techniques.

22           MR. LEITCH: But an inspection of the weld  
23 per se, you're talking mainly about the tube. The  
24 weld itself -- it's a very complex geometry.

25           MR. MATTHEWS: Yes, it is, and the weld is

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1 going to be very difficult to examine volumetrically.

2 MR. LEITCH: So the 25 plants that are  
3 going to do inspections -- I guess I'm not real clear  
4 what that means.

5 MR. SIEBER: They are visual.

6 MR. MATTHEWS: Those were intended to be  
7 visual, and I'm not sure the NRC is going to agree  
8 with that. But, you know, that's our intent.

9 MR. LEITCH: And then if the visual shows  
10 something, then --

11 MR. MATTHEWS: Yes. Anytime you find  
12 something on top of the head, you know, all bets are  
13 off. You got to go figure out what it is, and you got  
14 to figure out how bad it is and what the extent is,  
15 and if it is coming through-wall, you got to repair  
16 it.

17 MR. LEITCH: So these NDE techniques that  
18 are still under development are not intended to be  
19 operational by the fall outages?

20 MR. MATTHEWS: Some plants will probably  
21 do a best effort, which means they will put some  
22 probes in there and see what they see. But, you know,  
23 it's not a PDI type qualification. We don't have the  
24 time. We don't have the blocks, and we don't have the  
25 capability to do that type of qualification at this

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1 point in time. Eventually, we'll get there.

2 You know, the ID connected flaws -- we got  
3 there. We had very good qualification programs for  
4 all of the vendors who were doing those types of  
5 inspections. We are not there yet on the OD flaws.

6 MR. LEITCH; Now the photographs there at  
7 Oconee show that you had done some PT there,  
8 evidently.

9 MR. MATTHEWS: They did PT. What they did  
10 at Oconee on the first one they did, they found the  
11 boron. They did the eddy current, and there was  
12 nothing on the ID of the tube. Are you sure it's  
13 leaking? Then they went back, and they did more  
14 exams, and they couldn't find anything, and they  
15 finally did PTs.

16 The only thing they saw on the initial PT  
17 was a couple of little spots. We'll clean that up  
18 and, as they ground it into an axial flaw that was in  
19 the weld and the OD of the tube. The PTs that were  
20 done on Oconee 3 were on the leakers. Once they knew  
21 it was leaking, they went in, and they did PT on those  
22 leakers.

23 Did you do any PTs on any other nozzles?  
24 Those were the only ones they did PT on. PT -- you  
25 got a person standing there.

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1 MR. LEITCH: Yes, it's very high in  
2 radiation.

3 CHAIRMAN FORD: Any other questions?

4 MR. ROSEN: The PTs were under-head PTs.  
5 Right?

6 MR. MATTHEWS: Under the head, yes.

7 DR. BONACA: At Oconee, did they detect  
8 all the nine leaking nozzles by visual inspections in  
9 the first pass?

10 MR. MATTHEWS: Yes. I believe it was  
11 first pass. They looked. They saw them.

12 MR. ROBINSON: Mike Robinson again. We  
13 initially identified six leaking nozzles with the head  
14 on the vessel. We took the head off the vessel, did  
15 the clean-up, and at that point we saw three other  
16 nozzles that looked suspicious. We called those as  
17 potential leakers, and did our normal pre-repair NDE  
18 on those and, once we saw some indication there, we  
19 said we had the nine leakers.

20 DR. BONACA: The reason that I am asking  
21 is that I am still a little bit concerned about  
22 detectability. You know, they pointed out that it is  
23 difficult to distinguish those boron crystals on top  
24 of the head from leakage from the flange, from actual  
25 leakage around the nozzles.

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1           The reason why I am raising it is that  
2 plants will go through a visual inspection first, and  
3 is it so sure that just visual will identify these  
4 cracks?

5           MR. MATTHEWS: We feel that visual will  
6 find it.

7           DR. BONACA: Well, in this case, for  
8 example, they only identified six. Now if those six  
9 were not leaking, the other three would not have been  
10 seen.

11          MR. MATTHEWS: No. Six were identified  
12 before they even took the head off the vessel. The  
13 other three were identified once they did a more  
14 thorough exam with the head on the stand.

15          DR. WALLIS: It's not clear that these  
16 leaks have come out -- you see something coming out  
17 the top or they are actually the worst thing. You  
18 could have a very fine leak of steam with a crack  
19 actually growing circumferentially inside, which  
20 wouldn't -- you know, you have a very small leak,  
21 because you've got a very tight tube up there. It  
22 doesn't really tell you what is happening inside where  
23 the crack could be growing circumferentially.

24          MR. MATTHEWS: Right. Well, the only  
25 three circumferential flaws that have been found were

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1 also associated --

2 DR. WALLIS: But you are lucky that you  
3 have a big enough leak before you get the  
4 circumferential crack growing that you can see it.  
5 It's a race between these different things that are  
6 going on at the same time.

7 MR. MATTHEWS: We haven't seen any  
8 evidence of any kind that would have a crack --

9 DR. WALLIS: But the leak is not a symptom  
10 of the degree to which the circumferential crack has  
11 grown.

12 MR. MATTHEWS: Oh, that's true.

13 DR. WALLIS: It's a symptom of the degree  
14 to which an axial crack has grown, presumably, and  
15 also the ability of this pressure -- this what do you  
16 call it, fit, this tight fit, to let something come  
17 out.

18 MR. MATTHEWS: To let it out, yes. We as  
19 an industry don't want to manage this issue by looking  
20 for leaks. That's not the right way to manage it. We  
21 want to develop the tools and a program for the  
22 industry that is going to be more proactive than  
23 trying to find a leak and fix it.

24 Just for the near term, the technology is  
25 where it is, and that is what we have, and that is

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1 where we were trying to go for this -- Fall outage is  
2 what we are saying.

3 CHAIRMAN FORD: Unless there are any other  
4 major questions right now, I would like to adjourn the  
5 --

6 DR. WALLIS: A procedural thing: Are we  
7 going to give some advice about what to say before the  
8 main committee this afternoon? I think he needs some  
9 advice about what to tell us tomorrow, because we  
10 can't possibly go through all this tomorrow.

11 MR. MATTHEWS: Oh, no.

12 DR. WALLIS: Are we going to do that this  
13 afternoon?

14 CHAIRMAN FORD: Let's hear the NRR, and  
15 then we'll give advice.

16 DR. BONACA: Also we should ask the NRC if  
17 maybe the staff wants to just give a presentation  
18 without any --

19 CHAIRMAN FORD: Hold on, guys. We are  
20 adjourning now until -- Recess until 12:20.

21 (Whereupon, the foregoing matter went off  
22 the record at 11:36 a.m.)

23  
24  
25

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A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(12:23 p.m.)

CHAIRMAN FORD: I would like restart this subcommittee meeting. Jack, would you like to introduce your team?

MR. STROSNIDER: Yes. I have a few opening comments, and then I will introduce the staff.

My name is Jack Strosnider. I am Director of the Division of Engineering. First of all, I wanted to start off by thanking the Committee for setting up this session and hearing this issue today. I know you have a very busy schedule. However, we do think it is very important that the Committee understand this issue and understand about the staff's approaches to dealing with it.

We see this as a major issue in terms of addressing our principal performance goal of maintaining safety, and that is why we are going forward with the Bulletin. So, again, I think it is important for the Committee to understand what we are doing there.

I also want to say thanks to Larry Matthews and the industry for their presentation. I think, if nothing else, I want to say we appreciate that they went first today.

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1                    Seriously, I think they did give a good  
2 summary of what the issue is, and also what we know  
3 and what we don't know. That is part of the reason,  
4 when we talk about what we don't know, why we are  
5 looking at a bulletin.

6                    The bulletin we are talking about is a  
7 request for information, and that request for  
8 information is intended to help us verify compliance  
9 with existing regulations, and also to determine what  
10 additional future regulatory actions might be  
11 appropriate.

12                   With regard to some of the questions --  
13 and I think the Committee did a very good job this  
14 morning focusing in on some of the major issues which  
15 have also been of concern to the staff. I am going to  
16 tell you right up front that the staff doesn't have  
17 the answers either.

18                   So when you go forward with your  
19 discussion this afternoon, recognize that we don't  
20 have all the answers. Again, that is the reason we  
21 are going out with this request for information.

22                   Now requests for information can sound --  
23 That might sound somewhat benign, but in fact, I think  
24 when you see some of the discussion we had with regard  
25 to issues like how do you qualify your visual

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1 examinations and things like that, that there are some  
2 challenges in there for the industry, most definitely,  
3 in order to be able to answer some of the questions  
4 and address the technical issues and the regulatory  
5 aspects.

6 As far as expectations or requests from  
7 the Committee, we are on a schedule for issuing this  
8 bulletin August 1. That's our milestone. We will go  
9 up to the Commission something on the order of ten  
10 days or so before that through an information  
11 Commission paper.

12 We would like to see a letter from the  
13 ACRS that would support that schedule and provide your  
14 perspective on the staff's approach technically and  
15 process in terms of how we are addressing the issue.

16 With that little introduction, I would  
17 just point out that then we have at the table -- We  
18 have Al Hiser and Mark Reinhart, Tad Marsh and Ed  
19 Hackett in the Office of Research.

20 Al is going to walk through basically what  
21 the bulletin request looks like, some of the  
22 information we are looking for, and some of our  
23 thought process, what's behind that.

24 Mark is going to talk about the risk  
25 perspectives that we have been able to develop to

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1 date. Ed Hackett is going to summarize for you an  
2 effort that the Office of Research undertook with  
3 regard to this issue. They have contracted four  
4 experts who are sitting at the table across from us  
5 here to take a look at this issue from a technical  
6 point of view, and he is going to summarize their  
7 efforts and going to point out that we got a lot of  
8 really good support there. His people did some hard  
9 work in a short time. We appreciate that effort.

10 Tad Marsh is going to talk about the  
11 process, what the generic communication process is  
12 and, I think, a little bit about the schedule, some of  
13 which I just mentioned.

14 So with that, I will turn it over to Al  
15 Hiser.

16 MR. HISER: Thank you. Hi. I am Alan  
17 Hiser with Materials and Chemical Engineering Branch  
18 of NRR. What I want to do is discuss the NRC staff  
19 activities in this area and, in particular, the draft  
20 bulletin that the staff is proposing at this point.

21 (Slide change)

22 MR. HISER: The slides that are in the  
23 package that have been handed out include a lot of  
24 background, and what I'll do is skip over that and  
25 jump right to slide 5. But in addition, I want to

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1 talk about the staff approach, applicable regulations,  
2 the staff assessment that has been performed to date,  
3 and then go into details on the proposed information  
4 request in the bulletin.

5 In terms of safety perspective, again on  
6 slide 5, failure of a CRDM nozzle does constitute a  
7 LOCA and control rod ejection, which are analyzed  
8 events. Some of this, Mark Reinhart will go over a  
9 little bit later, some of the more detailed things.  
10 I just wanted to sort of take a big picture  
11 perspective on things.

12 From existing PRAs, one would indicate  
13 that a level of risk exists here that requires  
14 increased attention. I think that is what we are  
15 putting on this.

16 Now to go back a little bit to Larry's  
17 presentation, the worst case crack that was found at  
18 Ocone with a high susceptibility plant did have a  
19 remaining ligament margin of about 6 to failure.  
20 There is about 180 degrees remaining in the crack.  
21 Failure would be predicted to occur with about a 30  
22 degree ligament remaining.

23 DR. WALLIS: Do you know that by some kind  
24 of visual examination?

25 MR. HISER: Do I know which part of it?

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1 DR. WALLIS: How do you know that you've  
2 got this much left?

3 MR. HISER: The structural integrity  
4 calculations.

5 DR. WALLIS: Did you cut the thing apart  
6 to find out or how did you know that you had this big  
7 a ligament left?

8 MR. HISER: That's what the licensee  
9 indicated from their examination.

10 DR. WALLIS: Did they use a surface visual  
11 examination, superficial?

12 MR. HISER: I believe they did ultrasonic  
13 -- I'll let Mike Robinson address that.

14 MR. ROBINSON: The 165 degree arc is the  
15 arc link that was repaired once we found --

16 DR. WALLIS: You actually took it apart  
17 and looked at it?

18 MR. ROBINSON: We looked at part of it,  
19 but in the course of repairing the indication, we  
20 ground out an area that was in the 165 degree --

21 DR. WALLIS: so it's a pretty good measure  
22 of what happened?

23 MR. ROBINSON: Yes, sir.

24 DR. WALLIS: Thank you.

25 MR. HISER: Based on this experience, we

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1 have no reason to conclude that cracking won't affect  
2 additional units. We have no reason to believe that  
3 in Oconee units, in particular, with the  
4 circumferential cracking are unique in any way  
5 fabrication-wise, construction-wise or operation-wise  
6 that would indicate that they are the only units that  
7 would be affected.

8 We do think that timely, effective  
9 inspections would provide additional information on  
10 the extent of the problem, and would provide us with  
11 confidence that safety is maintained and that  
12 regulatory requirements are satisfied.

13 (Slide change)

14 MR. HISER: Now looking at the overall  
15 staff approach to this, we held a public meeting with  
16 the industry on April 12 of this year. We requested,  
17 and the industry submitted, a report in May. Larry  
18 went over, I think, in pretty good detail the contents  
19 of that report.

20 The staff did submit questions to the MRP  
21 initially in a FAX form and then formally near the end  
22 of June, and we held a public meeting with the  
23 industry in early June where they presented initial  
24 responses to our questions.

25 From the information that we have seen,

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1 the staff has concluded that we should propose a  
2 generic communication. The purposes of this  
3 communication are to assess compliance with  
4 regulations and to provide staff with information on  
5 licensee actions that they propose to address the  
6 issue.

7 In particular, we are looking to determine  
8 the prevalence and severity of PWSCC in vessel head  
9 penetration nozzles. The one caution I would lay out  
10 is that the staff is in, say, the first step of a  
11 multi-phase effort where at this point we are in an  
12 information gathering phase and, based on the  
13 information, we will determine the need for additional  
14 regulatory actions and what the nature of those  
15 actions should be.

16 DR. WALLIS: On page 5 you talk about  
17 timely effective inspections. Are you going to tell  
18 us what kind of inspections those are?

19 MR. HISER: I will provide some details on  
20 what we think they should be.

21 DR. WALLIS: Are you going to tell us that  
22 looking for boron crystals on the outside is a true  
23 indication of what is happening inside?

24 MR. HISER: In some circumstances, we  
25 think that can be the case.

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1 DR. WALLIS: Okay. That's a pretty  
2 equivocal answer.

3 MR. HISER: Very equivocal situation.

4 (Slide change)

5 MR. HISER: What I would like to do is go  
6 ahead and skip slide 7, which would just be restating  
7 what Larry described this morning, and then just go  
8 into a little bit of detail of the staff concerns with  
9 the MRP report.

10 The first thought that the staff had on  
11 the report is that the susceptibility model has large  
12 uncertainties to it. We know it doesn't encompass all  
13 of the factors that are important. It only looks at  
14 operating time and the time that the plant was  
15 operating -- operating time and operating temperature.

16 We do believe that the susceptibility  
17 model provides a useful plant ranking relative to  
18 Oconee Unit 3 from which the staff has some ideas on  
19 how to address the overall problem, and we do  
20 acknowledge. I think the industry addressed a little  
21 bit this morning, that this is not a predictive model.

22  
23 Plants predicted to be within X EFPY of  
24 Oconee Unit 3 will not necessarily develop cracking at  
25 that time. It may be subsequent to that. It may be

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1 prior to that. It's not a predictive model. It is  
2 just a relative ranking of where the plants lie.

3 DR. WALLIS: Now this morning we talked  
4 about uncertainty, and we didn't get some quantitative  
5 evaluation. Did you do a quantitative evaluation of  
6 these uncertainties?

7 MR. HISER: No, we haven't.

8 DR. WALLIS: It would seem important to do  
9 that, because you've got this nice curve. But if  
10 there is a great deal of uncertainty, then it doesn't  
11 tell you as much as you would like it to tell you.

12 MR. HISER: I think, as we go into the  
13 staff presentation, you will see that we are not  
14 focused on the susceptibility model. What we are  
15 doing is allowing it to give us some information on  
16 which plants may be more susceptible and to help us in  
17 our information gathering process.

18 DR. KRESS: Now one view could be taken,  
19 that Oconee might have equivalent stresses or even  
20 stress distributions across the rods, tubes around it,  
21 encompass the full range of stresses, that it has the  
22 same chemistry and that the material construction of  
23 these tubes are about the same, and that the weld  
24 materials are the same.

25 So that in terms of uncertainty, these

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1 things are captured in the Oconee case, and the only  
2 variable that is really different from it and the  
3 other plants is the time and temperature.

4 In that case, seems to me like it would be  
5 a predictive model, because you know when Oconee went,  
6 and in ranking things relative to it on a time-  
7 temperature basis, you have captured perhaps the  
8 uncertainty, and it would be predictive in terms of  
9 when to expect these other plants to have the same  
10 problem Oconee had.

11 What is wrong with that view?

12 MR. HISER: Oh, I think that's a  
13 reasonable view, but given the uncertainty that exists  
14 in the model, if we say a particular plant is one EFPY  
15 away from Oconee, I wouldn't want to go back in a year  
16 and then expect to find cracking.

17 There may be incipient cracking at the  
18 present time. It may be that there are some local  
19 fabrication methods or something like that that would  
20 maybe push them out further in time.

21 I think the uncertainty really lies in --

22 DR. KRESS: What I had in mind there was  
23 not all the Oconee tubes cracked, just some of them.  
24 It was those that had the extreme ends of the  
25 uncertainty. Now you talk about another plant. You

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1 wouldn't expect maybe it to not crack within one or  
2 two years or whatever the prediction is, because it's  
3 not going to have the extreme ends. But what you can  
4 say, it's not going to crack before this time. That's  
5 the important part.

6 DR. WALLIS: I am not sure about that.  
7 How many cracked at Oconee?

8 MR. HISER: There were nine nozzles  
9 cracked, two --

10 DR. WALLIS: Okay, nine out of so many.  
11 Suppose it's a statistical thing with some  
12 probability. If it were one out of, now that tells  
13 you something. It's nine out of. So the chance of  
14 not getting one out of in some other one is not the  
15 same as the chance of not getting nine out of.

16 I would think someone would do some  
17 statistical analysis about that.

18 MR. STROSNIDER: This is Jack Strosnider.  
19 I would like to comment on this question, if I could.

20 I think if you try to look at this in  
21 terms of all the random variables that are involved in  
22 susceptibility or when cracking is going to occur,  
23 you've got a long list. You've got the time. You've  
24 got the temperature. You've got the microstructure.  
25 You've got some fabrication history. We don't know

1 about -- that you don't know about in terms of how  
2 things might have been bent or what cleaning solvents  
3 might have been used, etcetera.

4 So you could come up with a long list of  
5 random variables that would have to go into the  
6 evaluation. Now I think the question that Dr. Kress  
7 was asking is could you assume that Ocone represents  
8 the spectrum, a spectrum of those.

9 I don't think we can necessarily make that  
10 assumption. Number one, we don't have the information  
11 to confirm it. But number two, when we look -- I  
12 think if you look back at the 97-01 experience where  
13 some microstructural data was available, there's a  
14 certain number of heats that were used at Ocone, but  
15 you don't know that you've got the worst heat. It  
16 certainly doesn't represent every heat material that's  
17 out there.

18 Just as an example, come back to the  
19 earlier question with regard to doing an analysis to  
20 understand the variability in terms of the uncertainty  
21 of this model. That's something we would all like to  
22 do, but in order to do that, you have to exactly the  
23 sort of data that I'm talking about, which --

24 DR. WALLIS: But when you've got a complex  
25 model like -- situation like this, you can make some

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1 sort of simplified statistical model.

2 MR. STROSNIDER: Right. But I think at  
3 this --

4 DR. WALLIS You can make some postulates.  
5 Then, it seems to me, you can get sort of the  
6 probability of one, two and three, based on that  
7 model, and you've got nine happening here. So that  
8 you cannot just -- Then your curve that we show would  
9 tell you something about the probability of nine  
10 occurring at these other plants.

11 We really want to know an estimate of the  
12 probability of one occurring in a plant. Seems to me,  
13 you could do that based on some gross guess of the  
14 kind of statistical --

15 DR. KRESS: Well, you have to make some  
16 guess about how representative --

17 DR. WALLIS: -- a distribution or one of  
18 those magical things.

19 DR. KRESS: It's like he said. You have  
20 to make some --

21 DR. WALLIS: But do it. Show us an  
22 analysis that predicts something and not just words.

23 MR. STROSNIDER: I would suggest you have  
24 to be very careful, because when you start trying to  
25 predict probabilities of things occurring like that,

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1 you are going to have to define the populations, the  
2 statistical populations; and I come back again to you  
3 need the data that we were talking about that we don't  
4 have in order to define those populations.

5 DR. WALLIS: But you have to do something.

6 MR. STROSNIDER: We have looked at things  
7 from a statistical point of view in terms of sampling,  
8 and I think we can talk about that when we get to it.

9 DR. WALLIS: So someone has done that?

10 MR. STROSNIDER: Yes, but it's not the  
11 level of detail that you are looking for, because as  
12 I said in my introductory remarks, we don't have the  
13 information to do that analysis.

14 Yes, you can make some assumptions, but  
15 how many assumptions are you willing to make? So at  
16 this point --

17 DR. WALLIS: Well, make the simplest  
18 assumptions to get started, and see what you come up  
19 with. And then explain it.

20 MR. STROSNIDER: Agreed. But at this  
21 point the assumption we are making is that there's  
22 uncertainty in the susceptibility ranking.

23 DR. WALLIS: Well, that's not an  
24 assumption. That's a given.

25 MR. HISER: One of the industry

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1 recommendations in the report was that plants within  
2 10 EFY of Oconee Unit 3 should take some extra  
3 precautions, I guess, in doing their examinations.  
4 They should make sure they were extremely careful.

5 From the staff review of Generic Letter  
6 97-01 modeling that was performed, Arkansas Nuclear-1,  
7 Unit 1, was at that point predicted to be more than 15  
8 years away from -- based on susceptibility.  
9 Four years later --

10 DR. WALLIS: Away from what?

11 MR. HISER: I'm sorry?

12 DR. WALLIS: Away from what?

13 MR. HISER: Away from being susceptible to  
14 PWSCC.

15 DR. WALLIS: Well, they are all  
16 susceptible. You mean having cracks that go through?

17 MR. HISER: Actually, the model at that  
18 point was in comparison to DC Cook. So it was again  
19 in a relative ranking sense, Arkansas Unit 1 was 15  
20 years away from having a susceptibility --

21 DR. WALLIS: The same kind as Oconee?

22 MR. HISER: Same conditions. Well,  
23 actually, the same as DC Cook Unit 3 at that point.

24 MR. HAMILTON: If I could comment -- John  
25 Hamilton from Energy Nuclear.

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1           The statement is correct that Arkansas  
2 Nuclear 1 was ranked relative to DC Cook, to the  
3 benchmark of DC Cook under 97-01. When the current  
4 MRP rankings were based on just time and temperature  
5 and excluding the material factors gives -- moves ANO-  
6 1 into a position comparable to Oconee.

7           MR. HISER: Yes, the point we want to make  
8 is that modeling retrospectively is able to explain  
9 things, but in trying to use a model in a predictive  
10 manner in any sense, the 10 EFPY threshold would not  
11 be supported based on that experience. It may be in  
12 five years we come back and say, well, the model did  
13 an excellent job.

14           I guess the only point is we don't think  
15 10 EFPY is the proper threshold to cut off additional  
16 attention.

17           DR. WALLIS: You have a very good initial  
18 model which enables you to interpret new data as it  
19 comes in. It may be that after a year you will get  
20 more or less confidence in that model. MR. HISER:  
21 Right. Absolutely.

22           Now the staff also had questions regarding  
23 the adequacy of visual examinations for detection of  
24 boron. As Larry pointed out, the observations at  
25 Oconee were that there were very small quantities of

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1 deposits. Less than one cubic inch is what has been  
2 quoted.

3 The staff concerns related to, first of  
4 all, the variability in the interference fits from  
5 plants to plant. I think we found that the drawing --

6 DR. WALLIS: Can I go back to that. Did  
7 they do tests of the ones that did not show boric acid  
8 deposits to show that, if there were big cracks, there  
9 would be necessarily boric acid deposits? I mean, did  
10 they do tests to show that the ones that did not have  
11 deposits were not cracked?

12 MR. HISER: No.

13 DR. WALLIS: Well, I would think you have  
14 to do that.

15 MR. HISER: At Oconee --

16 DR. WALLIS: Your whole hypothesis is  
17 that, if there's a crack, there's a leak, and there's  
18 a boric acid deposit, if it's a big enough crack.

19 MR. HISER: At Oconee they found nine  
20 leakers, Oconee Unit 3. They did ultrasonic  
21 examinations of those nine plus an additional nine,  
22 and found no additional cracks.

23 DR. WALLIS: No additional cracks in the  
24 other nine?

25 MR. HISER: Correct, in the other nine.

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1 That's out of 69 total in the head. So they did  
2 volumetric examination of 18 --

3 DR. WALLIS: So it's a sample, and then  
4 you would have to look at some kind of statistical  
5 model to tell whether that was a good enough sample  
6 and all that sort of stuff.

7 MR. HISER: Right. Absolutely.

8 DR. WALLIS: But your hypothesis says that  
9 you can use the presence of boric acid crystals as a  
10 true indication of the kind of cracks you are worried  
11 about.

12 MR. HISER: That is the industry's --

13 DR. WALLIS: Somebody's hypothesis.

14 MR. HISER: Right, that's industry's  
15 assumption, and that's what the ASME code assumes at  
16 the present time.

17 MR. ROBINSON: Alan, just to add also that  
18 on Oconee-1 we looked at an additional eight nozzles  
19 for extent of condition, and of those eight that we  
20 looked at, we found similar conditions like we found  
21 on Unit 3, again just some minor craze cracking in  
22 nozzles that were not leaking.

23 So we looked at a sample on both Unit 1  
24 and Unit 3. The extent of condition inspection showed  
25 only the minor craze type cracking.

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1 DR. WALLIS: You would think there would  
2 have to be some which are on the point of leaking and  
3 have pretty big cracks. But you didn't find anything  
4 like that?

5 MR. ROBINSON: No, sir.

6 DR. WALLIS: There must be some in the  
7 intermediate stage, presumably. They have to go  
8 through that stage, don't they?

9 MR. ROBINSON: They have to go through the  
10 stage, but of the ones that we inspected, we didn't  
11 find any like that.

12 DR. WALLIS: So it's a big of a conundrum.  
13 You've got the ones that cracked and leaked and the  
14 ones that didn't crack much at all. There's nothing  
15 in between.

16 MR. ROBINSON: And that's the mystery of  
17 this thing. If you look at the two samples of the  
18 nozzles that are leaking and the ones that we have  
19 examined and are not leaking, they are like two  
20 entirely different populations.

21 You've got the severe cracking in the ones  
22 that do leak. You have minor craze cracking in the  
23 ones that aren't leaking.

24 DR. WALLIS: That's disconcerting, because  
25 it means there may be some cause which we don't know

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1 about which is causing some to crack much more than  
2 others.

3 MR. HISER: Can we clarify one thing? The  
4 leaking nozzles -- there were cracks found in all  
5 leaking nozzles.

6 MR. ROBINSON: This is true.

7 MR. HISER: Okay. In one nozzle at Oconee  
8 Unit 1, there was a part through-wall, OD initiated  
9 circumferential flaw. It's about 20 percent through-  
10 wall.

11 MR. ROBINSON: On Oconee-1 it was a crack  
12 that initiated in the weld that moved into the nozzle  
13 base material and traveled up to the annular area, and  
14 that crack was radial and totally axial. There was no  
15 -- I'm sorry, there was a small circ piece to the one.  
16 But Unit 2 we did find a small circ crack on Unit 2.

17 MR. HISER: Okay, Unit 2. So you could  
18 call that the intermediate step. Unit 2 did have a  
19 part through-wall circumferential crack.

20 Now back to the --

21 DR. KRESS: So are you saying 15 years  
22 would have been a better choice? Fifteen effective  
23 full power years?

24 MR. HISER: I think something more than  
25 ten. Again given the differences in the models, ten

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1 does not seem to be sufficient was our conclusion. In  
2 a few slides, the staff looks at the susceptibility  
3 rankings, and we have some conclusions on appropriate  
4 subpopulations to look at from the plants.

5 CHAIRMAN FORD: Just to -- As you go  
6 through this, these are the staff concerns arising out  
7 of industry MRP whatever the number was, 44.2.

8 MR. HISER: Right.

9 CHAIRMAN FORD: And the resolution of  
10 those concerns have to be resolved before the fall  
11 outages or before the fall/spring or two outages?

12 MR. STROSNIDER: This is Jack Strosnider.  
13 Let me see if I can respond to that.

14 If you look -- When we get into the  
15 information we are requesting in the generic letter,  
16 we talk about if a plant does not intend to perform  
17 inspections before a certain date, they need to  
18 provide a justification. The justification would have  
19 to address these sort of issues.

20 In fact, it's the industry's  
21 responsibility to respond to these questions and to  
22 provide the information necessary to support safe  
23 operation of the plant.

24 Now that doesn't mean that we aren't, you  
25 know, as the technical staff, trying to understand

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1 these things ourselves through our research  
2 activities, etcetera, but the whole process we are  
3 working through here is to get a communication out to  
4 the industry that says you need to provide your basis  
5 for when you are inspecting and what your technical  
6 justification is, and it needs to consider all these  
7 sort of issues.

8 CHAIRMAN FORD: Okay, I understand. Keep  
9 going.

10 MR. HISER: Okay. Now again, some of the  
11 problems with the small quantities of the deposits are  
12 the variability in the interference fit and how that  
13 may restrict deposits flowing from the crack up to the  
14 top of the vessel, and also the tightness of PWSCC  
15 cracks.

16 I think we had a quote earlier today of  
17 one gallon of leakage at Oconee over a 12-month  
18 period. So there is not much leakage from these  
19 things.

20 DR. WALLIS: One gallon a year?

21 MR. HISER: In a year. Yes, Oconee Unit  
22 3 had cleaned the head 12 months earlier, then did a  
23 visual in a 12-month period. Now that assumed --  
24 Well, that's what they found.

25 DR. WALLIS: One gallon a year? The

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1 velocity up the crack is very, very low, isn't it?  
2 And yet we are told it carries boron up there. It's  
3 in solution, because it's vaporized.

4 Again, it will be useful to have someone  
5 explain an analysis of these things in terms of these  
6 sorts of numbers. I mean, is it a diffusion  
7 phenomenon, a flow phenomenon. What happens to the  
8 boron? Where do you expect to find it? What kind of  
9 concentrations?

10 Is someone going to present this sort of  
11 thing?

12 MR. HISER: We don't have information on  
13 that. I mean, again that's --

14 DR. WALLIS: Well, I mean if I've got  
15 something like this in a class of graduate students,  
16 I would say go away and do some homework; make some  
17 calculations about flow rates, rates of this, that and  
18 the other, come back with some answers tomorrow.  
19 Right? With the best that you know.

20 MR. STROSNIDER: If I might interject,  
21 that's basically what the purpose of the bulletin is,  
22 telling the industry to go off and get those answers.

23 DR. WALLIS: So wait and do all the  
24 paperwork and then someone sits down and does some  
25 thinking. Is that what happens?

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1 MR. STROSNIDER: Well, we'll get into the  
2 work that we've been doing. As I mentioned earlier,  
3 Research brought contractors on board to start looking  
4 at this issue, and we are trying to do that.

5 DR. WALLIS: You have so much inertia to  
6 get going.

7 MR. STROSNIDER: I'm sorry, I didn't hear  
8 you.

9 DR. WALLIS: You seem to have so much  
10 inertia to get going on something.

11 MR. STROSNIDER: Maybe we'll address more  
12 of this as we get through the presentation.

13 MR. HISER: So the staff has -- Regarding  
14 the visual inspection, staff really has two concerns.  
15 One is: Is there sufficient deposit that is available  
16 on the head for detection; and secondly, what are the  
17 difficulties involved in identifying the leakage or  
18 the deposits that one sees and identifying whether  
19 they came from vessel head penetration nozzles or from  
20 other sources, as indicated here.

21 Now one point that, I guess, I would like  
22 to make regarding insulation, just to make sure that  
23 we have a clear understanding of the situation  
24 regarding insulation -- This is a similar schematic to  
25 what Larry showed this morning.

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1           The insulation at, I guess, all of the B&W  
2 is in a horizontal position like this, such that the  
3 head surface is readily available for inspection.  
4 Many of the plants, I think, from Westinghouse and  
5 Combustion Engineering, the insulation is contoured to  
6 the head and, in some cases, offset by several inches,  
7 providing a gap through which one could do some sort  
8 of an inspection.

9           In other cases, it is either directly  
10 lying on top of the head or is even adhered to the  
11 head. So the difficulties in doing the visual  
12 inspections in those cases are -- The problems are  
13 clear and were not addressed at all in the industry  
14 report.

15           As we discussed earlier today, the  
16 remaining ligament margins that the industry cited in  
17 the report did not include a clear discussion of time  
18 margin and crack growth rate. Their response to our  
19 REI questions did provide some information on that.

20           Sort of sum up the staff concerns, we are  
21 concerned that a plant -- or a nozzle could reach a  
22 critical crack size before one is able to detect  
23 leakage. With the visual examinations, these are on  
24 a periodic basis, depending on the cycle length for  
25 the plants.

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1           There is no continuous monitoring that  
2 could provide any intermediate assurance that there  
3 was no leakage occurring. And in addition, the  
4 inspection under insulation needs to be addressed.

5           Now the report itself did not provide too  
6 much discussion on postulated accident analysis and  
7 risk insights. The staff perspective will come from  
8 Mark Reinhart, and the staff again is really concerned  
9 with how -- this issue regarding compliance with the  
10 regulatory requirements in this case.

11           (Slide change)

12           MR. HISER: Now regarding the regulatory  
13 requirements, the staff has gone through the  
14 regulations and the next two slides provides some  
15 detail on areas that we think there would be  
16 questions.

17           10 CFR 50.55a references Section XI of the  
18 ASME Boiler and Pressure Vessel Code, and in  
19 particular the code does not permit through-wall  
20 cracking of pressure boundary components.

21           Technical specifications for each plant  
22 also do not permit through-wall leakage. Clearly, if  
23 we have boric acid deposits, those that are not  
24 attributable to flange connections or things like  
25 that, then there would be questions about compliance

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1 with these.

2 The General Design Criteria in Appendix A  
3 -- you know, we have particular criteria that we think  
4 apply in this case, if not in a regulatory sense, then  
5 at least in a philosophical sense: That one should  
6 not have -- or one should minimize probability of  
7 rapidly propagating fracture of the reactor coolant  
8 pressure boundary, and the reactor coolant pressure  
9 boundary should have extremely low probability of  
10 abnormal leakage.

11 (Slide change)

12 MR. HISER: Flipping to Slide 10, from  
13 Appendix B we have some of the criterion there that we  
14 think apply. One is control of special processes,  
15 which would include things like non-destructive  
16 testing, that they should be accomplished or  
17 controlled and accomplished by qualified personnel  
18 using qualified procedures in accordance with codes,  
19 standards, specifications, criteria and other special  
20 requirements.

21 In addition, activities affecting quality,  
22 from Criterion V, should be prescribed by documented  
23 instructions, procedures or drawings, including  
24 appropriate acceptance criteria.

25 Then Criterion XVI related to corrective

1 actions. Conditions adverse to quality should be  
2 promptly identified and corrected with a determination  
3 of the cause of condition and implementation of  
4 corrective action to preclude repetition of the  
5 problem. We think this applies not only to plant  
6 specific items requiring corrective action, but also  
7 from incidences at other plants. So we think that  
8 would apply in this case.

9 So these are the regulatory requirements  
10 than we think apply in this case.

11 (Slide change)

12 MR. HISER: Now looking at the staff  
13 assessment of the situation, looking at the  
14 susceptibility rankings that were provided by the MRP,  
15 the staff has identified subpopulations of plants  
16 based o their susceptibility.

17 There are four specific populations. One  
18 is those plants that have identified cracking at the  
19 present time. In particular, that would include the  
20 three Oconee units, along with Arkansas Nuclear 1.  
21 That's sort of a special subpopulation.

22 (Slide change)

23 MR. HISER: If we look at the overall  
24 susceptibility rankings, an inferior version of  
25 Larry's slide from this morning without the pretty

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1 colors -- If we look at the rankings in an overall  
2 sense, we identified, if you will, a natural break in  
3 the data at around 4 EFPY.

4 What we would submit is that the plants  
5 that are less than 4 EFPY away from Oconee Unit 3  
6 define a subpopulation.

7 DR. WALLIS: These are the cold plants and  
8 the hot plants?

9 MR. HISER: These would be probably, I  
10 guess Larry would say, the hot plants that have been  
11 operating for a long time.

12 DR. WALLIS: Well, I know, but the break  
13 is between the cold and the hot.

14 MR. HISER: No. This is --

15 DR. WALLIS: Different scale?

16 MR. HISER: Yes. This is the fine scale.

17 DR. WALLIS: Oh, I'm sorry. Excuse me.  
18 Yes, you are right.

19 MR. HISER: So this is the overall  
20 rankings. So if we look at this point down here at  
21 about 4 EFPY, look at plants below that as being a  
22 subpopulation. Then look at plants at about 30 EFPY,  
23 so between 4 and 30 EFPY is a separate population. We  
24 would have those three subpopulations, and then really  
25 this is a balance of plants.

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1 DR. WALLIS: Now if your uncertainties are  
2 the order of 2 EFPY, that would sort of mean that your  
3 distinction is no longer -- in the fine scale is no  
4 longer so significant. We don't know the  
5 uncertainties. They haven't been quantified for us in  
6 terms of EFPY.

7 MR. HISER: That's correct, but I think in  
8 the way that we choose -- that we have proposed to use  
9 these subpopulations, I think that we are just using  
10 it as a guide for information collection. We are not  
11 proposing any actions at plants at this point. We are  
12 just looking to gather information so that we can  
13 assess the magnitude of the problem at this point.

14 DR. WALLIS: I guess if you -- I'm sorry.  
15 If you knew something about what you think your  
16 uncertainty is, this would tell you about how  
17 surprised you are if you find a crack at, say, Number  
18 6 or 3.

19 MR. HISER: Right.

20 DR. WALLIS: So you do need to get your  
21 state of knowledge now in order in order to interpret  
22 any new data you get.

23 DR. BONACA: Before you move on, on slide  
24 Number 11, you had plants with low susceptibility, and  
25 you say that PWSCC not likely through current license

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1 period. Do you mean the 40 years of life?

2 MR. HISER: For the first 40 years. Yes.  
3 And those would be plants that are more than 30 EFPY.

4 DR. BONACA: So you have that kind of  
5 level of confidence in your predicting capability?

6 MR. HISER: We have a relative confidence  
7 at this point. The plants that are in the first three  
8 subpopulations, the first plants have demonstrated a  
9 problem. The second plants, second group of plants,  
10 we expect that it's likely to occur in the near term.

11  
12 For the plants that are between 4 and 30  
13 EFPY with moderate susceptibility, we don't think it's  
14 likely to occur in the near term, but it could occur.  
15 We would not be shocked based on uncertainties in the  
16 modeling.

17 DR. BONACA: Sure, I understand.

18 MR. HISER: The last group of plants  
19 clearly has lower susceptibility than the first group.  
20 This represents about a third of the PWRs. Any  
21 actions that might be required there clearly would be  
22 able to key off of findings from the first three  
23 groupings.

24 DR. BONACA: Yes. I was just focusing on  
25 the statement "current license period." That's a long

1 time.

2 MR. HISER: Right.

3 MR. STROSNIDER: This is Jack Strosnider.  
4 If I could interject just for a second a thought.

5 The way we are using these rankings is  
6 sort of a graded approach to the information that we  
7 are requesting. All right? So I think you will see  
8 some of that come together when we actually get into  
9 the information request, and how we use these  
10 different categories to say here's what we are asking  
11 licensees to provide us.

12 DR. BONACA: I understand, and I agree  
13 with the approach. When I read the words that you use  
14 there, it expressed some level of confidence that I'm  
15 not sure the current -- you know.

16 MR. STROSNIDER; And I don't think we want  
17 to express any level of confidence other than here's  
18 a graded approach to collecting information so that we  
19 can decide then what additional actions might be  
20 appropriate.

21 DR. WALLIS: However, we were told that  
22 you wouldn't be shocked if you found them, but you  
23 would be shocked if you found cracks in the bottom  
24 layer there, the 24 plants total.

25 MR. STROSNIDER: I think we would be very

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1 shocked.

2 DR. WALLIS: It would force you to  
3 reevaluate all your assumptions.

4 MR. STROSNIDER: Absolutely.

5 MR. HISER: I think that would be a very  
6 surprising occurrence, given that many of the plants  
7 are 100+ EFPY away.

8 As Jack mentioned, what we are looking to  
9 do within the bulletin is to verify compliance with  
10 the regulatory requirements, and we think this is best  
11 achieved through qualified examinations. On the next  
12 page, I'll go over what we think qualified  
13 examinations are.

14 This is a graded approach that is keyed on  
15 that the subpopulation at each plant is listed within.  
16 In this case, we think examination of 100 percent of  
17 the vessel head penetration nozzles is appropriate.

18 There was some discussion about the CRDM  
19 nozzles. There also are thermocouple nozzles. I  
20 think there are vent pipes in some of the heads.  
21 There are other penetration nozzles in the heads that  
22 are fabricated from similar materials and would be  
23 expected to have similar cracking histories.

24 Why do we think 100 percent of the nozzles  
25 is pertinent is that, from looking at the statistics

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1 of the situation, there really is no -- very little  
2 benefit to doing a small inspection, limited  
3 inspection of nozzles.

4 If you look at the leakage history of the  
5 nozzles, it's not even possible to define a certain  
6 part of the head as not having exhibited any leakage.  
7 So we think all nozzles are created equal and deserve  
8 equal attention in this case.

9 MR. STROSNIDER: Al, if I could interrupt  
10 you for just a second. There seemed to be some  
11 interest earlier in the statistical evaluation. Lee  
12 Abramson from the Office of Research is here. He  
13 assisted us in that evaluation. If you are interested  
14 in hearing about that, I would suggest maybe Lee could  
15 answer any questions you have.

16 DR. WALLIS: Maybe there's some data in  
17 curves. We could just be given the papers so we could  
18 look at them.

19 MR. STROSNIDER: Well, there's actually --  
20 We have a write-up with regard to some of the  
21 analysis, the sampling analysis that he put together.  
22 We could provide that.

23 DR. WALLIS: I think it would be more  
24 efficient than trying to do it orally.

25 MR. STROSNIDER: Okay. We can do it that

1 way.

2 (Slide change)

3 MR. HISER: Now regarding qualification of  
4 the examination methods, the staff has identified  
5 three --

6 DR. WALLIS: I'm sorry. Would you mind  
7 just going back to 12 for just a quick question. I  
8 just want to make sure.

9 (Slide change)

10 DR. WALLIS: The triangles -- This is  
11 really the cumulative number of units, isn't it, on  
12 the top?

13 MR. HISER: Yes.

14 DR. WALLIS: Cumulative number of units.  
15 So the three triangles down in the lefthand side  
16 there, that's the Oconee plants, and presumably  
17 there's another triangle somewhere farther up which is  
18 the ANO. Yes?

19 MR. HISER: Right. I'm not sure. It's  
20 one of these points. I know the industry -- We were  
21 told last week that this evaluation was their initial  
22 cut at things. They have gone back and have sharpened  
23 the pencil a little bit, and there's a little bit of  
24 shifting of some of the units.

25 DR. WALLIS: So there is a -- My eyesight,

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1 I can't tell the difference between some of your  
2 symbols there. But there is one associated with later  
3 at the top righthand corner, the far righthand one,  
4 later.

5 Now I can't read it very well, but the one  
6 that's furthest to the left on that graph -- isn't  
7 there one of those points at one year, effective power  
8 year, one of those things that's not supposed to be  
9 inspected yet? Is my eyes off?

10 MR. HISER: I would defer to Larry, if you  
11 have your color slide?

12 DR. WALLIS: Well, regardless of the  
13 specific question --

14 MR. MATTHEWS: There were two plants in  
15 under ten years that would not have had a refueling  
16 outage by -- I am not sure if that fourth dot on the  
17 graph is one of them or not.

18 DR. WALLIS: But that's how this graph  
19 would be used, is to say, well, hey, Mr. Plant, fuzzy  
20 on the righthand side, why aren't you inspecting  
21 before '02 or that's the reasoning behind this?

22 MR. HISER: Yes. I think our bulletin  
23 requests that they provide the basis for why they do  
24 not need to do inspection.

25 I think we're done with the susceptibility

1 rankings.

2 (Slide change)

3 MR. HISER: Okay. If we look at the  
4 examination methods, the staff has again provided a  
5 graded approach, if you will. For those plants with  
6 moderate susceptibility, we think a VT-2 visual  
7 examination that is qualified is a reasonable  
8 approach.

9 The qualification that we think is  
10 appropriate in this case is one that demonstrates the  
11 capability of detecting small amounts of boric acid  
12 deposits and the ability to discriminate deposits from  
13 VHP, vessel head penetration, nozzles and other  
14 sources. Presumably, if you can't say it's from  
15 another source, then you have to assume it's from one  
16 of these penetration nozzles.

17 Again, that would be appropriate for the  
18 moderate susceptibility plants, those from 4 to 30  
19 EFPY of Oconee, and that would represent 31 plants  
20 total, at least from the initial susceptibility  
21 rankings.

22 Now the next approach would be a plant-  
23 specific visual examination qualification. In this  
24 case, on a plant-specific basis we think that a  
25 demonstration would be required to demonstrate that

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1 VHP nozzle cracks will lead to deposits on the head,  
2 and that includes consideration of interference fits  
3 and other plant-specific as-built considerations.

4 DR. WALLIS: So the real question is  
5 whether you can detect enough boric acid in time  
6 before there is a circumferential crack which is  
7 growing sufficiently to cause you problems for all  
8 possible situations of interference at some whatever.

9 MR. HISER: That's exactly right.

10 DR. WALLIS: And we haven't seen any  
11 quantitative analysis of that. It's just someone's  
12 hope that that's the case?

13 MR. HISER: We would expect some sort of  
14 a demonstration that that is the case.

15 DR. WALLIS: I think you need that.

16 MR. HISER: If it cannot be demonstrated,  
17 then we think that visual examination is not  
18 appropriate. You have to be able to demonstrate that.

19 In addition, again the two-step process.  
20 Step 1 is, if boric acid leaks out, it will come to  
21 the surface. The second part is that, if it's there,  
22 that I'm able to find it. So I must be able to  
23 reliably detect it, and also identify the source of the  
24 leakage. That would include considerations of things  
25 such as insulation, preexisting deposits or other

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1 impediments to the visual examination.

2 DR. WALLIS: We heard about lithium.  
3 Where does the lithium go when it comes out?

4 MR. HISER: I haven't heard of detection  
5 of lithium.

6 DR. WALLIS: Where does it go? You only  
7 find boron on the outside. You don't find any  
8 lithium?

9 MR. HISER: I'm not sure what was found at  
10 Oconee, if it was only boron or if they did any --

11 DR. WALLIS: Well, is this lithium borate  
12 or what is this stuff that you are seeing?

13 MR. FYFITCH: Steve Fyfitch, Framatone.

14 The boric acid concentration in the  
15 reactor is anywhere from about 1800 ppm down to zero  
16 as you go through the cycle. The lithium  
17 concentration is 2 ppm down to almost zero.

18 So the amount of lithium in the boron that  
19 you are finding on the head is so minuscule, it's hard  
20 to detect it.

21 DR. WALLIS: But it's enough to make the  
22 environment in the crack region possibly alkaline.

23 MR. FYFITCH: If it were to concentrate,  
24 yes.

25 MR. HACKETT: This is Ed Hackett. I think

1 I would add a further comment to that. Dr. Sieber  
2 mentioned earlier, too, that the species that I think  
3 you would be concerned about is lithium hydroxide, and  
4 it's a much more volatile situation than the boric  
5 acid.

6 So probably, in addition to the  
7 concentrations, that would be another reason why you  
8 are not seeing any deposit or anything like that.

9 DR. BONACA: I would like to ask a  
10 question then. Just Ocone performed an inspection  
11 the previous cycle. Right? And there was no  
12 indication of leakage. Now they performed this  
13 inspection and found some circumferential cracks that  
14 extend almost half the circumference. Some were less.

15 Either from a detectability standpoint or  
16 from a crack growth rate standpoint, what does it tell  
17 us? I mean, I hear projections now that it will take  
18 many years before these cracks can extend beyond that.  
19 Is there someplace where you are going to address  
20 these issues or talk about them?

21 MR. HISER: Not within the context of the  
22 bulletin. What I can --

23 DR. BONACA: Did I explain what my trouble  
24 is there?

25 MR. HISER: My understanding is that

1 Oconee Unit 3 at its previous outage had completed  
2 cleaning of the head, and at that point they had a  
3 clean head that they were able to do effective  
4 detection of the boric acid. One year later they  
5 detected boric acid.

6 DR. BONACA: So it may have been that  
7 there was some leakage, but it was not identified.

8 MR. HISER: The one comment that I heard--

9 MR. ROBINSON: This is Mike Robinson,  
10 again from Duke Energy, and I'll try to address your  
11 question; because we asked ourselves the same  
12 question.

13 We had the Unit 1 outage in November of  
14 last year, and that's when we first found the first  
15 signs of leakage on top of the head. Unit 3 had been  
16 down for its refuel earlier than Unit 1. We had to  
17 bring Unit 3 offline in February for a maintenance  
18 outage.

19 We started back in 1993 and in '94 cutting  
20 the holes in the service structure and doing head  
21 cleanings during each refuel outage to get the heads  
22 to a good condition to where we could do good visual  
23 inspections.

24 When we did the inspection on Oconee 1 and  
25 found the leak -- again, that was prior to Oconee 3

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1 coming down. The fellow who does our inspections,  
2 obviously, became a whole lot more sensitized to what  
3 to look for.

4 Prior to finding leaks on Oconee 1, the  
5 expectation was, if you have a leak through one of  
6 these nozzles, you're going to find pounds of boron on  
7 top of the head, much like what we saw down at VC  
8 Summer.

9 So the mindset was, if you are looking for  
10 leakage, you would expect to see something fairly  
11 large, and again it was just a total shift for us once  
12 we did see something that looked suspicious to now  
13 identify that as true leakage.

14 We suspect on Oconee 3 that we had had  
15 some leakage in prior years. We suspect, although you  
16 can't prove, but we think we had some cracks at the  
17 point of actually going through-wall to where we did  
18 see the leak once we came down for the forced  
19 maintenance outage.

20 DR. BONACA: Okay. This explains to me a  
21 little bit why, and there may have been some leakage  
22 before. However, what you are telling me gives me  
23 concern about how much it will take, how long it will  
24 take for the future plants to be able to identify. I  
25 mean, what you are telling me is that you need

1 significant cleaning of the head before you can really  
2 be sure that you can see a leakage.

3 MR. ROBINSON: A real key is to have a  
4 good clean head.

5 DR. BONACA: That's right, and many of  
6 these plants do not have.

7 DR. WALLIS: Well, it tells us something  
8 else. The real leak started several years ago. Then  
9 the zero hour for your graph certainly change.

10 MR. HISER: That may be true.

11 MR. ROSEN: What is the expectation here?  
12 Do we think the nine cracks that we found at Ocone  
13 are all the cracks that's going to happen to that head  
14 or is it eventually are they all going to crack?

15 MR. HISER: I don't think the staff  
16 believes they are the only nine that would ever  
17 develop in that head. Given the distribution of the  
18 phenomenon, you know, we are some point early in the  
19 curve. I would expect ultimately, if you run the  
20 plant long enough, every one will crack.

21 MR. ROBINSON: Again, we think that PWSCC  
22 is a like a cancer. Once it starts, it's going to  
23 continue to grow. We know we have susceptible  
24 material. We know we've got the temperatures, all the  
25 kind of things that you need for this phenomena to be

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1 there.

2 That's one of the reasons we have made the  
3 decision to replace the heads at Oconee.

4 DR. BONACA: Thank you.

5 MR. HAMILTON: John Hamilton with Energy  
6 Nuclear. I might comment on the ANO experience in the  
7 outage previous to this spring. There was a visual  
8 inspection, and there was some boric acid in the  
9 vicinity of the nozzle that we found leaking this  
10 spring.

11 In the previous outage that boric acid was  
12 examined, and we've attempted to determine where it  
13 was coming from. The determination at that time was  
14 that it was not a control rod nozzle leak. A  
15 photographic record was made, and in the outage in the  
16 spring we again examined it using a robotic video  
17 camera, and concluded that it was a control rod nozzle  
18 leak at that time.

19 What we have now done is that we cleaned  
20 the head thoroughly after the outage and made another  
21 baseline video record so that, any future outage,  
22 we'll be able to easily determine what the situation  
23 is.

24 DR. BONACA: But still, I mean, for this  
25 20-odd plants that will inspect their head over the

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1 next nine months, what I understand is it there will  
2 be difficult to characterize a small leakage, because  
3 the heads are now clean.

4 I'm trying to understand, because if you  
5 look at it, you cannot characterize it. You cannot  
6 make any conclusions. Then the best you can do is to  
7 commit to another inspection two years from now, maybe  
8 year and a half, whatever the cycle length is, which  
9 puts off quite a bit the time which they are  
10 detectable.

11 MR. STROSNIDER: This is Jack Strosnider.  
12 I think, when you see -- when we get to how we have  
13 constructed the information request, you will see that  
14 we are trying to address that issue. If licensee  
15 cannot perform a qualified or plant-specific qualified  
16 visual examination, then they need to provide a basis  
17 why they are not doing a volumetric examination.

18 DR. BONACA: Okay.

19 MR. STROSNIDER: I think when we get  
20 through -- when you see how we've structured that, we  
21 have tried to address that issue, because it's not  
22 clear that waiting outage after outage to collect that  
23 kind of data is acceptable.

24 MR. MATTHEWS; This is Larry Matthews  
25 again. In some of the slides I showed, many of these

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1 plants don't have anywhere near the degree of masking  
2 boric acid sitting on their heads that the B&W units  
3 do, because they don't have those flanged CRDMs. They  
4 have Conoseal or canopy seal welds that seal those up  
5 pretty good.

6 Now some plants have canopy seal weld  
7 leaks occasionally, too, but those get cleaned up. So  
8 like the Robinson picture I showed, that's a pretty  
9 clean look, and Salem was, too.

10 So, you know, it's not like every plant is  
11 sitting here with half a ton of boron sitting up  
12 there, and you're trying to pick a teaspoon out. It's  
13 not that way at all the plants, certainly, and I think  
14 the B&W plants have been working on their issue for a  
15 number of years.

16 MR. STROSNIDER: Just to follow up on that  
17 thought for a second, I would just point out that  
18 recognize that the bulletin is addressed to all the  
19 PWR licensees. This is a plant-specific issue when  
20 you start asking what is the condition of the head.

21 So, really, it's probably not possible to  
22 come up with a generic solution to that. You have to  
23 go out to each licensee, and they have to assess the  
24 condition of their head and whether they can  
25 effectively perform this sort of examination. So

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1 that's another reason that we are looking at a  
2 bulletin.

3 MR. HISER: In terms of a qualified  
4 volumetric examination, this would be one that has a  
5 demonstrated capability to reliably detect cracking on  
6 the outside diameter of vessel head penetration  
7 nozzles.

8 In this case, we think it's appropriate  
9 for plants that have identified cracking. As I think  
10 Mike Robinson said, the cancer is there. We just want  
11 to determine how far it's spread. At this point we  
12 think that's four units altogether.

13 We think this would also be appropriate as  
14 a default if the visual examination cannot be  
15 qualified, either the VT2 visual or the plant-specific  
16 visual, and clearly would be applicable to any plant  
17 that finds leakage, because then, again, we know they  
18 have the disease.

19 (Slide change)

20 MR. HISER: IN terms of the proposed  
21 information request, the request is to licensees, and  
22 we ask them to provide within 30 days of the issue  
23 date five particular items.

24 Actually, Item 1 is pertinent to all  
25 licensees. Items 2, 3 and 4 are to the various

1 subpopulations, and then Item 5 is also pertinent to  
2 all licensees.

3 Item 1 is for each plant to provide its  
4 plant-specific susceptibility ranking, and including  
5 all of the data used to determine that ranking, and  
6 also to provide a description of the vessel head  
7 penetration nozzles, including the number, the type  
8 and materials used to fabricate them.

9 This will provide us with a background on  
10 what is in each plant in terms of the nozzles and  
11 where they lie within the industry's susceptibility  
12 histogram.

13 Now for plants that have identified  
14 leakage or cracking in their nozzles -- and that again  
15 would be the three Oconee units and Arkansas Nuclear  
16 Unit 1 -- we ask them four specific questions.

17 One is to describe the extent of nozzle  
18 leakage and cracking that they have identified to  
19 date; to describe the inspections and other corrective  
20 actions that they have taken, repairs and other  
21 corrective actions.

22 We ask them to discuss their plans and  
23 schedule for future inspections, in particular, the  
24 type of inspection, the scope, qualification  
25 requirements and acceptance criteria.

1           Regarding how those planned inspections  
2 can be used to demonstrate compliance with regulatory  
3 requirements: If the inspection plans do not include  
4 inspections before the end of this year, we ask them  
5 to provide the basis for concluding that the  
6 regulatory requirements will continue to be met until  
7 the inspection is performed.

8           If the inspection plans do not include  
9 volumetric examination, which the staff had concluded  
10 earlier is appropriate, of all of their vessel head  
11 penetration nozzles, then we ask them to provide the  
12 basis for concluding that the regulatory requirements  
13 will continue to be satisfied.

14           (Slide change)

15           MR. HISER: So that's the information  
16 request for plants who have demonstrated cracking.  
17 For those that the staff identified as high  
18 susceptibility -- in other words, those plants within  
19 4 EFY of Oconee Unit 3 -- as ask them to describe the  
20 vessel head penetration nozzle inspections that have  
21 been performed in the last five years so that we have  
22 a background on the types of inspections that they  
23 have been able to perform based on things such as  
24 insulation and preexisting boric acid deposits.

25           A second question is for them to provide

1 the plans and schedule for future inspections.

2 Item 3 relates to how their planned  
3 inspections will meet the regulatory requirements. if  
4 the inspection plans do not include any inspection  
5 prior to the end of 2001, then we ask them to provide  
6 the basis for concluding that they will continue to  
7 meet the regulatory requirements until they perform  
8 their inspection; and if their inspection includes  
9 only visual examinations, to discuss corrective  
10 actions, including alternate examination methods such  
11 as volumetric, if leakage is detected.

12 CHAIRMAN FORD: On Item c(1), I'm  
13 assuming that the scenario is that they have found a  
14 boric acid deposit at the top of that tube. If the  
15 regulatory requirement is that they cannot go through  
16 the pressure boundary, which I am assuming would be  
17 the circumferential crack going all the way through,  
18 a lot is going to depend on how they reply to you for  
19 the disposition curve or the crack propagation item.

20 MR. HISER: c(1) assumes that they do not  
21 plan to do any inspection in the short term, during,  
22 say, the fall outage season.

23 CHAIRMAN FORD: Okay. But it's still the  
24 same thing. Provide basis for concluding the  
25 regulatory requirements, i.e., they won't have a

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1 through-wall crack, will continue to met until the  
2 inspections are performed, i.e., some ISI period.

3 MR. HISER: Right.

4 CHAIRMAN FORD: In the future. That's  
5 going to depend on how satisfied you are with the  
6 velocity stress intensity disposition curve. Yes? So  
7 are you going to have before the event your approved  
8 disposition curve, what you will accept? Would you  
9 accept a disposition curve based purely on crack  
10 growth rates in the primary coolant?

11 MR. STROSNIDER: Al, let me interject.  
12 This is Jack Strosnider, because I was going to  
13 address this later in my concluding remarks.

14 We are asking for these assessments,  
15 basically, to come in from the industry, and one of  
16 the important things is going to be that we have some  
17 continuing dialogue as they are developing what these  
18 responses are going to look like; because it's not  
19 going to serve anybody well if we come in in the  
20 September time frame or so and we have a disagreement  
21 on whether it's an appropriate answer.

22 So -- But recognize there is a real  
23 challenge here in terms of, if you want to tie it to  
24 crack growth data, you know, what's going to be able  
25 to be done by that time. But the best answer I can

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1 give is that I think we need to have this continuing  
2 dialogue.

3 We have had good communications with the  
4 industry, and that needs to continue. But we do  
5 recognize that we are taking on an issue where in the  
6 September time frame we are going to get these  
7 responses and have to determine whether we think they  
8 are adequate or not.

9 DR. WALLIS: Well, can we be more  
10 specific? Are you going to require that they analyze  
11 the effect of concentration of lithium hydroxide in  
12 the space, possible effects of it, or that they make  
13 an analysis, an assessment of it?

14 MR. STROSNIDER: I would suggest that, if  
15 their justification -- If they are going to provide a  
16 justification for some later date of examination than  
17 what is in this request, then they are going to have -  
18 - and if it includes some assumed crack growth rates,  
19 that we are gong to have to have discussions on the  
20 technical basis for those growth rates.

21 DR. WALLIS: Well, discussions -- I mean,  
22 if they come back with an assessment which completely  
23 ignores, in effect, which we've questioned at this  
24 meeting, are you going to accept it?

25 MR. STROSNIDER: It could come back

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1 perhaps and assume some very high growth rates.

2 DR. WALLIS: Assume? I mean --

3 MR. STROSNIDER: I think the answer to  
4 your question is we expect them to address those types  
5 of issues and providing a credible technical basis.  
6 Yes, they need to understand the environment and the  
7 growth rate, if that's what they are going to rely on.

8 DR. WALLIS: Well, I think you ought to  
9 come back with the technical questions to which you  
10 want answers and not leave it all up to some kind of  
11 dialogue. You ought to specify we want these  
12 technical questions answered. -- just wait for you to  
13 make an assessment and see whether or not you want to  
14 raise those questions.

15 MR. STROSNIDER: And in fact, we have  
16 provided the industry with a list of technical  
17 questions on several different previous occasions.  
18 Those are already documented, and it includes the kind  
19 of things you are talking about.

20 DR. WALLIS: Thank you.

21 (Slide change)

22 MR. HISER: For the plants with moderate  
23 susceptibility, those with susceptibility rankings  
24 from 4 to 30 EFPY of Oconee Unit 3, we ask them to  
25 discuss their plans and schedule for future

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1 inspections. Question b. is that, if inspection plans  
2 do not include a visual examination at the next  
3 scheduled refueling outage, to provide the basis for  
4 concluding that the regulatory requirements will  
5 continue to be met until they perform the inspections.

6 Then the last item on this page is, I  
7 guess, identified as 5 in the draft bulletin. For  
8 plants with refueling or scheduled maintenance  
9 outages, within 30 days after restart we ask them to  
10 describe the extent of nozzle leakage and cracking  
11 that they have identified and, Item b. there, if the  
12 inspections, repairs and corrective actions are  
13 different from those that they provided to us  
14 previously, we will ask them to describe what they  
15 actually did.

16 DR. BONACA: For plants with the low  
17 susceptibility, you have no requirement at all?

18 MR. HISER: They would fall under Item 5  
19 at this point.

20 DR. BONACA: Item 5?

21 MR. HISER: Again, the bulletin is a short  
22 term, Phase I, if you will, of trying to gather  
23 information from those plants. We wouldn't really  
24 expect to find anything.

25 DR. BONACA: Last bullet on page 17?

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1 MR. HISER: Yes. This is Item 5. I'm  
2 sorry, they should have been numbered instead of with  
3 bullets.

4 DR. BONACA: So everybody has to answer  
5 that question?

6 MR. HISER: Right, for the last one. That  
7 is the proposed information request.

8 (Slide change)

9 MR. HISER: In terms of the proposed  
10 required responses, this is what licensees must  
11 provide us. The other is a request, in all honestly.

12 Within 30 days of the date of the  
13 bulletin, we ask them to submit a written response  
14 indicating whether they will submit the requested  
15 information from the three previous slides, and  
16 secondly, whether the requested information will be  
17 submitted within the requested time period.

18 Now both the requested information and the  
19 required responses are both 30 days. This could be  
20 one submittal. Could be two submittals. If they were  
21 to provide us for Item 2 here that they will not meet  
22 the requested time period, then clearly, that would be  
23 a second response.

24 For addressees who choose not to submit  
25 the requested information or are unable to satisfy the

1 requested completion date, they must describe in their  
2 response any alternative course of action that they  
3 propose to take, including the basis for the  
4 acceptability of the proposed alternative course of  
5 action.

6 So that would be the required response.

7 CHAIRMAN FORD: Allen, we've got exactly  
8 one hour left. I would like to put aside a quarter of  
9 an hour anyway at the end of the talk. It's quarter  
10 past one. Just so that we have some general comments  
11 from the subcommittee and, more importantly, give you  
12 advice as to what is going to happen tomorrow.

13 Bearing that, we've got three more talks,  
14 and I could leave it up to you to decide. You've  
15 heard some of the comments that went on this morning,  
16 and they are cut and paste or whatever it is to  
17 individual contributions to address those concerns.  
18 That would be really helpful. But I want to leave a  
19 quarter of an hour aside for any general questions.

20 MR. MARSH: We'll prioritize the  
21 presentations for you.

22 CHAIRMAN FORD: I suppose sub voce that we  
23 had better keep quiet.

24 MR. LEITCH: Just one question regarding  
25 the Oconee units. From reading this, it appears as

1       though you are not requiring anything special of  
2       Oconee as far as a mid-cycle shutdown to take a look  
3       at these.

4               In other words, I would expect that the  
5       other CRDMs at Oconee are perhaps the highest  
6       susceptibility areas that we have, because we don't  
7       really understand exactly why some of them have  
8       cracked and some of them haven't cracked.

9               So is it correct that we are just allowing  
10       Oconee to operate on a normal refueling cycle?

11               MR. HISER: The bulletin that we propose,  
12       again, is step 1, just trying to gather information.  
13       Once we have input on what the licensee's plan and  
14       also what other additional data we would get from  
15       them, we would determine the need for additional  
16       regulatory action.

17               At this point, we are just in the  
18       information collection phase.

19               MR. LEITCH: Asking them what their plan  
20       is?

21               MR. HISER: Right. And again, with the  
22       proposed publication date of August 1, that,  
23       hopefully, would provide us with information by  
24       September 1. So we would be able to proceed at that  
25       point, once we have analyzed the submittals.

1 MR. STROSNIDER: This is Jack Strosnider.  
2 I wanted to point out, if I understood the question,  
3 if you look at the information request for plants that  
4 have identified cracking, we are asking them to  
5 provide a basis. If they are not inspecting before  
6 the end of 2001, they have to provide a basis for  
7 doing that, and similarly if they are not doing a  
8 volumetric examination.

9 So I think that Oconee would fall into  
10 that case, and they would have to provide a  
11 justification why they are not going to take those  
12 kind of actions.

13 By the way, I do think Oconee, the unit  
14 with the circ cracks is shutting down this fall, and  
15 I think that would have been a shorter operating cycle  
16 than normal anyway, because the last shutdown was just  
17 this past spring.

18 MR. HISER: Okay, thanks.

19 MR. REINHART: I am Mark Reinhart, the  
20 Acting Chief of the NRR Probabilistic Safety  
21 Assessment Branch, and I'm going to talk about the  
22 risk perspective.

23 (Slide change)

24 MR. REINHART: So when you look at this  
25 next slide, it really should say developing risk

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1 perspective, gathering what we know now. We are  
2 looking at a situation where we have the  
3 circumferential crack CRDM, and we are saying one  
4 scenario could be a rod ejection. One scenario could  
5 be a LOCA.

6 The rod ejection would be reactivity  
7 concerns. We talked about that this morning, and I  
8 think our expectation is that most plants operate with  
9 the rods out. So we are not so much concerned other  
10 than maybe in the collateral damage arena.

11 DR. BONACA: Just a comment on this  
12 morning. I mean, because they are running with the  
13 rods out, you know --

14 MR. REINHART: Right. During the start-  
15 up.

16 DR. BONACA: -- effect of the SCRAM maybe  
17 equivalent of the rod ejection from zero power, which  
18 is the most severe. Then it is analyzed, always  
19 separation from the LOCA. You have to look at the two  
20 combined events.

21 MR. REINHART: Yes, absolutely.

22 DR. BONACA; It makes it a very  
23 complicated scenario.

24 MR. REINHART: It would. It definitely  
25 would. The LOCA we put in the medium category, trying

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1 to mix apples and apples. In IPE guidance, a 2 to 6  
2 inch break would be a medium LOCA. So that's why we  
3 considered that.

4 Both of these are analyzed events, but as  
5 we've brought out all morning and afternoon, there are  
6 a lot of significant uncertainties. So we are trying  
7 to gather information as we go and not lock ourselves  
8 in, but be ready to address those uncertainties when  
9 we can.

10 We are looking at various analyses and  
11 scenarios and struggling to see which fit, which don't  
12 fit, under which circumstance.

13 Collateral damage is one of our concerns.  
14 What will happen if a CRDM ejects? What type of  
15 internal, external damage would it cause? What about  
16 nearby control rod drive mechanisms? We don't know,  
17 but we want to try to understand that better.

18 Another concern is for plants that have  
19 blanket information on the head, the CRDM ejection,  
20 the medium LOCA, blowing that insulation, where would  
21 it go? Would it get in the sump or would it block  
22 recirculation? Injection and recirculation are key  
23 vulnerabilities in the medium break LOCA category.

24 So what we did, we said we are going to  
25 just see what we can say at this time, assuming --

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1 we'll take about a medium break LOCA, and we just take  
2 our core damage frequency to the simplest form. We  
3 have an initiating event frequency, and we have a  
4 condition of core damage probability, and we use the  
5 IPE data we have. For that initiating event  
6 frequency, we need to know a lot before we can really  
7 say much about it.

8 We talked about the chemistry, the  
9 materials, what mechanisms are involved, what are the  
10 synergisms, crack initiation, crack propagation,  
11 probability of rupture. All that needs to come  
12 together to really say what is the initiating event  
13 frequency.

14 So we said what can we say? Let's go to  
15 our basic equation, set that initiating event  
16 frequency equal to one. We will assume we have it.  
17 What does that give us in condition of core damage  
18 probability?

19 So if we looked at our IPE results, we had  
20 a spread. Most of them came into the  $10^{-2}$ ,  $10^3$  range.  
21 The highest outlier was 4.7 times  $10^{-2}$ , and the lower  
22 is categorized as less than  $10^{-4}$ . So there's a  
23 spread, but most of them fall in that  $10^{-2}$ ,  $10^{-3}$  range.

24 DR. BONACA: But those results was for a  
25 medium LOCA, right?

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1 MR. REINHART: I beg your pardon?

2 DR. BONACA: That was based on a medium  
3 LOCA.

4 MR. REINHART: Yes. Assuming we have an  
5 initiating event frequency of 1 for a medium break  
6 LOCA.

7 DR. BONACA: That's right. And so there  
8 is no consideration of possible damage tied to the rod  
9 ejection.

10 MR. REINHART: We are not looking at  
11 collateral damage there. We are not looking at  
12 operator action recovering there at this point.

13 DR. BONACA: That's a big --

14 MR. REINHART: Yes. It is part of the  
15 uncertainty. We expect the operator is going to be  
16 able to do a lot to mitigate this accident. We expect  
17 that there might be some collateral damage that might  
18 make it very difficult.

19 DR. BONACA: You mean the old -- the FSAR  
20 shows significant fuel damage for the zero ejection  
21 accident. So I just --

22 MR. REINHART: I beg your pardon?

23 DR. BONACA: All the FSARs or the  
24 neutronic analysis show some degree of fuel damage for  
25 rod ejection from zero power. I think that that's a

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1 potential candidate here that may bring that into the  
2 -2 or 3 to a much higher number.

3 MR. MARSH: Well, but the damage that is  
4 caused by the core -- caused to the core from the  
5 reactivity transient is not the same criteria that you  
6 look at in terms of dose rates and things for LOCA  
7 purposes.

8 You could get damage from reactivity  
9 transients, but the acceptance criteria for a LOCA is  
10 a different -- Now you're looking at damage caused by  
11 melting, not damage caused by reactivity.

12 In other words, that adds to the dose rate inside of  
13 containment but not due to off-site dose or things of  
14 that sort.

15 So you do accept some fuel damage.

16 DR. BONACA: If you have some center line  
17 melting or if you have some clad failure. I mean, it  
18 just happens. If it's there and if you have IE=1 and  
19 you have some fuel damage in -- That doesn't seem  
20 right.

21 MR. ROSEN: I don't think, Mark, that the  
22 presentation here showing an assumed initiating event  
23 frequency of 1 is very useful. I would prefer you  
24 just left that out and just talked about the  
25 conditional core damage probability, because we know

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1 it's not 1. We are not going to always have these  
2 things.

3 MR. REINHART: I agree, but by definition  
4 to get conditional core damage probability, that's the  
5 condition.

6 MR. ROSEN: Well, perhaps, but people can  
7 misunderstand that.

8 MR. REINHART: I very well understand  
9 that.

10 MR. ROSEN: And in that sense, I don't  
11 think it's very useful.

12 DR. WALLIS: It seems very strange. Did  
13 you deduce it from the CDF? I thought your CCDP was  
14 a separate calculation. Then you multiplied by the  
15 IE(f).

16 MR. REINHART: You can take your condition  
17 of core damage probability, and then you multiply it  
18 by initiating event frequency to get your core damage  
19 frequency.

20 DR. WALLIS: But assuming it is one, then  
21 you've got  $10^2$  and you've got 100 reactors. That's  
22 not acceptable.

23 MR. MARSH: It's only meant to show in the  
24 relative sense what the mitigation systems are in  
25 terms of their strength.

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1 DR. WALLIS: It's not very useful, though,  
2 is it?

3 MR. REINHART: Well, it is useful in the  
4 sense that we can home in on areas we need to look at,  
5 and we talked about we need to look at injection. We  
6 need to look at recirculation.

7 DR. BONACA: What they are saying: Given  
8 that, you have a break.

9 MR. REINHART: Right.

10 DR. BONACA: But the comment I am making:  
11 Given that you have a break, and they are not  
12 contending that the way you are dealing with, you  
13 know, if you have another event such as rod ejection  
14 that may give you fuel damage -- I'm not saying you  
15 will have it, but I'm saying you have to look at it,  
16 because I think it's credible -- then the number E-2  
17 to E-3 is one.

18 You have already a fuel damage there, and  
19 now if you had a hole in the system, you are going to  
20 have loss of coolant with fission product through it.  
21 I mean, in containment.

22 MR. REINHART: So you're postulating the  
23 worst case scenario of (a) you have the rod ejection  
24 from zero power giving you fuel damage.

25 DR. BONACA: Yes, and I'm not saying it is

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1 going to happen. I think, however, that the dynamic  
2 effects of it, given that you have all the rods out,  
3 may be that you are dropping the rods in the core, and  
4 one is stuck out. This is not purely a stuck rod  
5 evaluation for a margin evaluation. It is a dynamic  
6 effect.

7 If that is the case, you will have some  
8 fuel damage, and then you don't have to wait for a  
9 LOCA to cause you -- You already have it. So --

10 MR. MARSH: We are not trying to imply  
11 that this is the core damage frequency. That's not  
12 what this is.

13 DR. BONACA: No, this is only to say you  
14 have to look at it. You have to look at it.

15 MR. STROSNIDER: This is Jack Strosnider.  
16 I would really like to comment on this use of the  
17 conditional core damage frequency. All right? And I  
18 would like to put it in this context.

19 If you look at the situation the NRC is in  
20 right now, I would put it in the context of decision  
21 making under uncertainty, and you have to make a  
22 decision when you've got a lot of uncertainties  
23 involved here, and you have to make a decision about  
24 what the appropriate regulatory action is.

25 One thing that might help to inform that

1 decision is to understand the consequences of the  
2 event, should it occur. All right. So let's look at  
3 the conditional failure probability.

4 Let's assume that the event actually  
5 happens, and you look at the numbers here. These  
6 numbers tell you that you need to provide some  
7 increased attention on this. This is part of our  
8 basis for going the route of the bulletin and taking  
9 the action we are taking.

10 If these numbers were several orders of  
11 magnitude lower for this particular event, you might  
12 reach a different conclusion about your willingness to  
13 accept the uncertainties that are involved. Right?  
14 But when we look at these numbers, we conclude, no,  
15 there's the uncertainties associated with the  
16 potential for this event occurring.

17 When I look at the consequences of it, I  
18 need to better understand them, and I need to ask the  
19 industry to take some action to provide that sort of  
20 information, and that's what drives us to the  
21 bulletin.

22 DR. BONACA: Sure. My only problem was  
23 the numbers may be even higher.

24 DR. WALLIS: Well, you have to do  
25 something. If you are going to use numbers like E to

1 the minus two, that something might be draconian.

2 MR. STROSNIDER: I'm sorry. I didn't hear  
3 the last part of what you said.

4 DR. WALLIS: If you take one times E to  
5 the minus two and your CDF is E to the minus 2, then  
6 the action indicated may be far more severe than you  
7 are actually proposing to take, if you are going to  
8 throw around numbers like this.

9 MR. STROSNIDER: And I come back again to  
10 put this in the context of decision making under  
11 uncertainty. How strong should my action be to decide  
12 to understand the uncertainties associated with the  
13 potential for the initiating event? If I understand  
14 the consequences, that helps to tell me what I need to  
15 find out, and in this case we conclude we need to find  
16 that out.

17 DR. WALLIS: Your action has to be  
18 commensurate with the risk and, if you -- What I would  
19 like to see is how small does  $IE(f)$  have to be in  
20 order for the kind of actions that you propose to take  
21 to be commensurate with this risk.

22 MR. REINHART: I think you are raising  
23 good points. I think when I said this is a developing  
24 risk perspective, we are trying to put together what  
25 we can to just get ourselves a feel of where we are.

1

2

I think what Jack is saying is the bottom line of this slide. We know we need management attention. We have management attention. We have ongoing interest in the risk arena. We are trying to get information from industry.

3

4

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9

We appreciate your comments, and we'll definitely feed those in there as we go through the next iteration of the --

10

11

12

13

DR. WALLIS: Yes, but you see, my concern is your attention -- the degree of your attention must depend on your assessment of what IE(f) is, and saying it could be one doesn't tell us anything.

14

15

16

MR. REINHART: Well, since we don't know -- See, we don't know what it is, and we're not saying that it is. We are saying --

17

18

19

DR. WALLIS: But that tells us nothing. If you are assuming it is one, then your attention may not be adequate.

20

21

MR. REINHART: What would you propose we say it is then? Maybe I'm misunderstanding.

22

23

24

25

DR. WALLIS: Well, if you are going to assume it's one and there's a core damage probability of E to the minus 2 for all these plants, that's not acceptable, is it?

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1 MR. REINHART: We are not saying that  
2 that's the case. We are doing like a desktop scenario  
3 to try to get us --

4 DR. BONACA: I thought that those graphs  
5 were probably characterized as the probability of a  
6 small break LOCA will be still on the order of 10 to  
7 the minus 3. I mean, that's what we heard.

8 CHAIRMAN FORD: As I understand where you  
9 are right now is you are just trying to paint a worse  
10 case scenario, but you would answer the question do we  
11 shut all reactors down now. The answer is no.

12 MR. REINHART: Right.

13 DR. WALLIS: Why is it no?

14 MR. MARSH: Because the number is not one.  
15 It's 10 to the minus 3.

16 DR. WALLIS: That's silly. That's silly.  
17 If it is one, we shut them down, but it's not one. so  
18 we don't. That just tells you nothing.

19 MR. STROSNIDER: Let me try one last  
20 question here, and then I'll give up on it. But if  
21 the conditional core damage probability were 10 to the  
22 minus 6 as opposed to 10 to the minus 3 to 10 to the  
23 minus 2, would you have a different perspective on the  
24 discussion we are having today? That's the point we  
25 are trying to make.

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1 DR. BONACA: And the point I wanted to  
2 make is that that may be actually one, if in fact this  
3 would result in rod ejection; and the strength is more  
4 in the IE that we heard this morning, that the  
5 probability of a small break LOCA resulting from these  
6 cracks in the nozzles was more on the order of 10 to  
7 the minus 3. That's what we heard, and if there is --  
8 then still this is the order of what you expect for a  
9 small break LOCA.

10 MR. ROSEN: Take it for what it's worth,  
11 Jack. My original comment was that that's misleading,  
12 and I think this discussion -- and confusing -- This  
13 discussion makes that point.

14 DR. WALLIS: But I think that, logically,  
15 you should say, if you have 10 to the minus 6, you  
16 don't do anything. If it's 10 to the minus 4, you're  
17 satisfied. That means you have to take action to  
18 bring IE(f) down to 10 to the minus two.

19 MR. SIEBER: That's right.

20 DR. WALLIS: And you have to show somehow  
21 that all these things you are doing in this wordy way  
22 reaches that conclusion. I don't see any connection  
23 between the actions you propose to take, which sound  
24 reasonable, and the risk assessment.

25 DR. KRESS: I don't think it has to be 10

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1 to the minus 2. Ten to the minus 1 would probably do  
2 it. You're talking about a time frame involved of a  
3 few years, and I personally believe there is  
4 significant evidence to pin down an initiating  
5 frequency a little better, because we have this  
6 susceptibility analysis.

7 I think that is a way to get to this  
8 initiating frequency, and I think it only has to be  
9 about .1 and not 10 to the minus 2.

10 DR. WALLIS: Whatever it has to be, there  
11 has to be some logical connection --

12 DR. KRESS: I agree with you on that. I  
13 think they have to pin that down a little better,  
14 because the action that they take should be  
15 commensurate with the risk. That's the only way you  
16 can figure out what the risk is. You have to pin that  
17 number down to some extent.

18 CHAIRMAN FORD: As an uninformed risk  
19 analysis guy, I don't understand it. It's very  
20 helpful to me to -- You have used this worst case  
21 scenario, and you're telling us, okay, guys, we are  
22 concerned. We are not so concerned we're going to  
23 shut the whole fleet down tomorrow, and it's not such  
24 a minor problem that we can walk away from it.

25 Now you are going through on your final --

1 you are going to go through and refine it.

2 DR. WALLIS: They have not given any  
3 evidence that there's no reason for concern. If you  
4 put down here if it's one and you get CDF -- What are  
5 you saying then? There's nothing here that says it's  
6 less than E to the -2.

7 MR. MARSH: It is only going to get  
8 better. He's already assuming the event.

9 MR. HACKETT: This is Ed Hackett. Let me  
10 try a slightly different spin on this, because I think  
11 where Dr. Wallis is going is sort of what process are  
12 we following to get there for this initiating event  
13 frequency.

14 In that regard, I think there are several  
15 encouraging things. I'll, hopefully, discuss a few of  
16 them in my presentation, but Larry presented earlier  
17 the elements of a probabilistic fracture mechanics  
18 assessment. I think that is what needs to be done  
19 here.

20 I think part of the problem and part of  
21 the problem with us answering Dr. Wallis' question  
22 here and struggling, obviously, is that we haven't  
23 done that. We are trying to, you know, sort of  
24 marshall the resources and get the process together to  
25 do that, but that's what needs to be done.

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1 CHAIRMAN FORD: In fact, if you are going  
2 to cover part of that, may I suggest just from the  
3 point of view of timing, please go straight into your  
4 presentation, Ed, where hopefully you will cover some  
5 of these aspects.

6 MR. HACKETT: Sure.

7 CHAIRMAN FORD: Now I've managed to  
8 wrangle out another quarter of an hour from --

9 DR. BONACA: I want to say that the CCDP  
10 here in this context is still wrong. What I'm saying  
11 is that all you did, you took the IPEs and you look at  
12 the medium LOCA, and that's 10 to the minus 2, 10 to  
13 the minus 3, ignoring the potential consequences to  
14 core damage of the rod ejection.

15 DR. KRESS: Yes, you better take that  
16 seriously. You need to make the calculation and see  
17 what it is.

18 DR. BONACA: That's a true error to take  
19 the IPE medium LOCA, because here you don't have a  
20 medium LOCA. You have a rod ejection coming through.  
21 Okay? It may have no consequence. I haven't done the  
22 calculations. All I know, because I used to make some  
23 of these calculations myself, is that you may have  
24 some -- So just looking at the LOCA, conditional core  
25 damage is not enough.

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1 MR. REINHART: We appreciate that comment.

2 MR. SIEBER: On the other hand, during the  
3 start-up of a PWR, the way you start it up, the chance  
4 of getting a big reactivity excursion in the source or  
5 intermediate range is relatively small, because you  
6 are so heavily borated, and you pull your rods out  
7 first to generally the bottom of the bite, and then --

8 DR. KRESS: Yes, but here you just got the  
9 opposite.

10 DR. BONACA: This break has been around  
11 here for a year and a half.

12 DR. KRESS: The boron is depleted down to  
13 a fairly low level.

14 DR. BONACA: I am making the point that  
15 don't ignore it. Just you have to look at it, this  
16 number here.

17 DR. KRESS: I think you can -- You don't  
18 want to have this event happen, even though it's  
19 probably not a catastrophic event from the standpoint  
20 of a LERF or damage to the public. I think it's  
21 within your design basis accent. You're not even  
22 going to exceed 10 CFR 100. But if this thing  
23 happened, you would have a real problem. I don't  
24 think anybody wants this to happen.

25 So I think you need to take Mario's

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1 comments seriously and see what sort of -- You're not  
2 going to get extensive core damage, but you will get  
3 enough that you wouldn't want this to happen. So you  
4 better look at the neutronics and make a calculation  
5 to see what that does to you, that rod ejection,  
6 because I think he's absolutely right.

7 MR. REINHART: We have definitely written  
8 that down, and we will do that.

9 MR. HACKETT: I'll take off with what  
10 Office of Research was asked to do. I'm Ed Hackett.  
11 I'm Assistant Chief of the Materials Branch in the  
12 Office of Research.

13 (Slide change)

14 MR. HACKETT: This slide shows an overview  
15 of what NRR requested us to do and sort of some  
16 ongoing activities that we have.

17 We did form an independent group of  
18 experts, all of whom are here with one exception  
19 today. I'll talk about some preliminary conclusions  
20 and recommendations that came out of their work and  
21 some kind of integration of their work with what the  
22 staff has been doing.

23 In addition, we have ongoing support to  
24 NRR that's -- Hopefully, I guess in the best of  
25 senses, it's transparent, but we have ongoing support

1 to NRR that is in the areas that are specified here:  
2 EAC, non-destructive evaluation, structural integrity  
3 and fracture mechanics, and also PRA.

4 If the past is any indication, we are also  
5 planning on having our support principally in terms of  
6 our staff and contractors who are associated with non-  
7 destructive inspection technology being able to  
8 support inspection oversight activities for the  
9 upcoming outages.

10 (Slide change)

11 MR. HACKETT: The next slide -- I should  
12 point out, too, to try and stay consistent with Dr.  
13 Ford's request, I think there's a lot of this I can go  
14 over very quickly.

15 DR. WALLIS: It seems to me I looked at  
16 this. You ought to have someone who is going to tell  
17 you what the clues are likely to be, what kind of mass  
18 transfer and chemical events are likely to occur in  
19 these cracks and in these spaces. I don't see that  
20 expertise listed here.

21 MR. HACKETT: That is a good point, Dr.  
22 Wallis. Those are pieces that I think for the long  
23 term aspect of this problem need to be addressed.  
24 This group was put together largely to address some of  
25 the shorter term aspects, but I think we are going to

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1 get off into areas as you suggest as we go on. So we  
2 will hit those areas.

3 The folks who are on the independent group  
4 of experts, as I said, are all here right over at the  
5 table there to my right: Dr. Bill Shack, your  
6 colleague, from the Argonne National Lab on EAC; Dr.  
7 Steve Doctor from Pacific Northwest National Lab for  
8 NDE.

9 Gery Wilkowski and Richard Bass actually  
10 have collaborated a fair bit between leakage integrity  
11 and structural integrity. They are both here also.

12 The only non-PhD on the group, Mr. Mark  
13 Cunningham, couldn't be with us this afternoon, but  
14 basically I think Mark Reinhart has summarized what  
15 Mark would have said, had he been here.

16 (Slide change)

17 MR. HACKETT: The next slide shows what we  
18 asked the group to do. As Dr. Wallis was pointing  
19 out, there's really a short term and a long term  
20 aspect to this issue. We really at this point have  
21 been focused on the shorter term issue in terms of  
22 supporting NRR for the issuance of the generic  
23 communication, and also a little bit further afield  
24 for the guidance for the inspection activities for the  
25 fall outages.

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1 Jack mentioned in his opening remarks, and  
2 I would like to echo that, that we are very satisfied  
3 with what we are able to do, what the group is able to  
4 do in a very short time, and it's only about two weeks  
5 that they were able to pull together a fair amount of  
6 information that we are actually still in the process  
7 of digesting, and they are here to support us at this  
8 meeting today.

9 With that, I propose skipping over my  
10 slide five. I think we have pretty much beaten up the  
11 susceptibility evaluation, unless anyone has -- I  
12 don't think we have much to offer there at this point  
13 except to concur with a lot of what's been said.

14 DR. WALLIS: Well, what did the group of  
15 experts say about the industry model? Did they accept  
16 that? Did they not accept it?

17 (Slide change)

18 MR. HACKETT: The bottom line -- I'll just  
19 skip to that -- is the last bullet on the slide here.  
20 I think what it represents is the best shot you are  
21 going to get at this for right now.

22 DR. WALLIS: Is it good enough?

23 MR. HACKETT: I guess it remains to be  
24 seen. We are accepting it for now as sort of the best  
25 we got and, as Allen characterized in his presentation

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1 in trying to move on in terms of prioritization from  
2 there.

3 So, hopefully, the answer is yes, that it  
4 was good enough for that purpose, but I think only  
5 time is going to tell for sure.

6 (Slide change)

7 MR. HACKETT: In the area of EAC, we could  
8 spend a little bit more time at least. This is an  
9 area that, I think, a lot of the discussion here is  
10 focused on. It was a key driver or probably the key  
11 driver for this issue.

12 I think our consideration and speaking for  
13 the experts also is that the annulus region between  
14 the head and the VHP will be a site for concentration  
15 of aggressive chemical species. I don't think there  
16 is any doubt about that.

17 Also the initiation frequency and crack  
18 growth rates for the situation, as has been pointed  
19 out, are not known. We have not modeled that. That  
20 would be a very difficult thing to model. I think  
21 several of the ACRS members here have indicated what  
22 is really needed here is data.

23 I think this would be one of those cases  
24 where a couple of data points would be worth a  
25 thousand expert opinions, but we are not going to have

1 that near term. Hopefully, that is something we are  
2 going to be working toward.

3 I think we consider that initiation at  
4 multiple sites around the circumference is likely,  
5 once you get this kind of phenomenon occurring. That,  
6 obviously, complicates the situation immensely. When  
7 you look at the implications of that on an effective  
8 crack growth rate, it could make the crack growth a  
9 lot faster.

10 DR. WALLIS: You mean, the thing looks  
11 like a sieve.

12 MR. HACKETT: The potential for at least  
13 multiple initiations, hopefully, wouldn't be quite a  
14 sieve, but I think the situation could be that it is  
15 cracked at a number of locations around the  
16 circumference.

17 I think the crack growth -- I'll elaborate  
18 on the last bullet, too. The crack growth rates in  
19 excess of one inch per year are certainly possible.  
20 Dr. Shack in his examination went a little bit further  
21 than that, and I'll just elaborate on that briefly.

22 He examined some literature data that was  
23 specific to vessel head penetration materials. Albeit  
24 it is a limited dataset, but in looking at that and  
25 attempting to bound the crack growth rates in that

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1 data, what Bill found is an indication of a crack  
2 growth rate on the order of 30 millimeters per year.  
3 It's a little bit over an inch per year.

4 In contrast with, I think, the industry's  
5 submittal or response to NRR's recent set of questions  
6 was indicating more about half that growth rate, maybe  
7 about 15 millimeters per year. I think Bill in his  
8 analysis indicated that that would represent more of  
9 a 30 percentile type number, if that sounds right,  
10 Bill.

11 DR. KRESS: But you would still have three  
12 more years before Oconee has a ligament problem?

13 MR. HACKETT: Well, the complicating  
14 feature there is the fact that these also only address  
15 PWSCC conditions, existing data. There has been an  
16 awful lot of speculation and discussion here about  
17 what this concentration of the chemical species in the  
18 crevice would do.

19 I think everyone would probably consider  
20 it would make the situation worse. So the \$64  
21 question is how much worse. We don't know the answer  
22 to that right now.

23 MR. HISER: Actually, it would be half  
24 that, because you have two tips growing. So it is  
25 effectively the equivalent of two inches.

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1 DR. WALLIS: There is no two-tip, because  
2 you have multiple sites.

3 MR. HACKETT: It could be more. It could  
4 even be more than two.

5 DR. SHACK: Now again when I did that, I  
6 came up with -- Even for the PWSCC, there's a  
7 distribution of crack growth rates. It depends on the  
8 heats of material. It sort of looks log normal. You  
9 know, we said it was log normal. It even looks log  
10 normal.

11 The one inch per year is kind of like the  
12 98 percentile, and go to what industry's model is. It  
13 was -- a log normal distribution, something like a 33  
14 percentile. So there is a distribution of rates, but  
15 the one inch per year is -- I consider 98 percentile  
16 an upper bound.

17 CHAIRMAN FORD: Well, now you've got the  
18 interesting situation. It's exactly analogous to data  
19 that was available for low alloy steel pressure  
20 vessels. You've got an enormous crack propagation  
21 rate, which you can't live with.

22 So how do you regulate that? How would  
23 you regulate that, which is the situation?

24 MR. HACKETT: That is what -- Maybe if we  
25 could hold that to the end, I'll try and come to that.

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1 I think at least it's unfortunate I have to go this  
2 far to make that kind of case, but one of the things  
3 that would argue for the fact that they are not fast  
4 is we haven't seen anything.

5 We haven't seen penetration accidents, you  
6 know, worldwide at this point. So they are probably  
7 not that fast, but we don't have the data to show it  
8 at this point.

9 One other point I wanted to make in this  
10 area is another point that Dr. Shack brought out in  
11 his analysis. We didn't discuss this much earlier  
12 today, but a limiting step as regards the environment  
13 here is likely to be the initiation in through-wall  
14 growth or through-weld growth on the J-groove weld.

15 One of the things you could look at, and  
16 I think Dr. Wallis was going to this earlier, was the  
17 situation with the welds are likely to be more  
18 variable for all the usual reasons that metallurgists  
19 would offer, and the bottom line is -- So you are  
20 likely to see a lot of variability and shouldn't be  
21 surprised in that, you know, one happened at Oconee in  
22 one location and didn't happen in other places. But  
23 then you get the propagation -- or you get the  
24 initiation and propagation to that J-groove weld. Now  
25 you have a much more uniform population of vessel head

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1 penetration housings.

2 Then you are probably going to start to  
3 see a fairly aggressive attack fairly fast after that.  
4 So I'll come back to this in the examination aspect,  
5 but I think what it points to is that's a limiting  
6 step, and that maybe needs to be a bit of a focus for  
7 some of the non-destructive examinations.

8 I would also propose in the interest of  
9 time skipping the next slide, because I think we  
10 covered the boric acid deposit annulus leakage issue.

11 DR. WALLIS: There was a question about  
12 what you learn when you see boric acid deposit in  
13 terms of what is happening inside and how sure you can  
14 be about what is happening inside from the amount of  
15 boric acid you see on the outside. That connection  
16 needs to be made.

17 MR. HACKETT: I would agree, and it has  
18 not been drawn conclusively. I think I would tend to  
19 concur with a lot of what I heard here this morning,  
20 in that from what we have seen and what the experts  
21 have said, what is going to happen is you are going  
22 from a very tight PWSCC crack in a J-groove weld into  
23 this relative -- I think Bill referred to a relative  
24 chasm of an annulus, and you are going to flash right  
25 there.

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1           There's a huge delta P across there, and  
2 you are going to start the concentration at that  
3 point. So from the standpoint of what that means to  
4 the EAC part of it, it is obvious that you are  
5 concentrating a species.

6           What it is going to do with regard to the  
7 accumulation of boric acid crystals and what makes it  
8 way out, I think, is a much more complicated issue.  
9 I think it is obviously highly uncertain as to exactly  
10 what is going to come out of there at this point.

11           So maybe I'll just summarize by saying  
12 that without going through the slide.

13           (Slide change)

14           MR. HACKETT: Another important aspect  
15 that we will be coming up on, once we get through the  
16 near term focus on the issuance of the generic  
17 communication is the issue with the inspections, and  
18 that's been very thoroughly covered today, too.

19           Just to reiterate some of it, I think  
20 volumetric examinations are indicated for plants with  
21 known cracking. Allen covered that. It depends on  
22 how you take the meaning of preferred, but I think it  
23 would be the preferred inspection method for high  
24 susceptibility plants in general, but that remains to  
25 be seen, what's going to be done.

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1           The vendors: It is known, obviously, that  
2 there are current equipment capabilities, but as Larry  
3 pointed out, not currently qualified inspection  
4 methods for the OD phenomenon.

5           I think it's fair to say the inspections  
6 can be effective, if adequate pre-qualifications can  
7 be performed. But then you are going to be down to  
8 the issue of the limitations on the number of methods,  
9 likely to be UT methods, and teams that could be field  
10 for these fall outages.

11          I think industry has talked about  
12 estimates on the order of four or five teams that  
13 might be able to be fielded potentially, or maybe it's  
14 not even that high. That is, obviously, something  
15 that needs to be looked at hard.

16          The other point I would add to this that  
17 I didn't get on the slide is back to this inspection  
18 of the J-groove welds. I think a combination of  
19 Bill's write-up along with Steve Doctor's would be  
20 indicating that that could be a very pacing item here.

21          If you are going in looking in the fall  
22 outages with the method that you are going to be  
23 looking under the head -- and let's just take the  
24 scenario where you find a crack in a J-groove weld,  
25 but you don't seem to find cracks in the housing. I

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1 still think that is going to be a situation where  
2 people aren't going to rest real easy.

3           Once you are cracking through that J-  
4 groove weld, I think you are going to start to have  
5 some problems pretty quick. So looking at the J-  
6 groove welds then, you have to talk about -- There was  
7 some discussion earlier. That's obviously a very  
8 difficult inspection.

9           Penetrant exams are a possibility but, you  
10 know, you have dose considerations unless you can do  
11 that in an automated sense. Probably more likely are  
12 eddy current or UT, if that kind of tooling can be  
13 developed.

14           At any rate, I think there is a  
15 recommendation there that that would probably be a  
16 good thing to focus on.

17           (Slide change)

18           MR. HACKETT: We were also asked, and the  
19 group was asked to comment on online monitoring for  
20 leakage or cracking. This is an interesting area,  
21 because the bottom line is it is technically feasible.  
22 It has been demonstrated, especially abroad. There is  
23 an online leakage monitoring system that EDF is  
24 employing at right now, I believe, about 25 of the  
25 French plants that uses N-13 monitoring. It is

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1 supposedly effective down to one liter per hour type  
2 of leak rates.

3 Acoustic emission monitoring has been  
4 demonstrated in this country in nuclear plant  
5 applications for identifying cracking in plants.

6 DR. WALLIS: This is a whistling?

7 MR. HACKETT: Basically, you are looking -  
8 - It's an acoustic signal that you would get from the  
9 crack propagation or initiation.

10 DR. WALLIS: It's from the crack? It's  
11 not from the steam squirting through?

12 MR. SIEBER: It's the fluid. You can't  
13 hear the crack.

14 DR. WALLIS; It's the steam squirting  
15 through.

16 MR. SIEBER: All these are very gross  
17 kinds of things. If you are talking about a gallon  
18 per year or a gallon per month, acoustics isn't going  
19 to find it. N-13 will not find it or N-16. You can't  
20 find it by radiation, because if you are sitting right  
21 on the reactor head, it's pretty hot there.

22 MR. HACKETT: Dr. Sieber goes exactly to  
23 one of the conclusions that the industry reached in  
24 their response to the NRC, is that a lot of these  
25 would have some real problems in the --

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1 MR. SIEBER: I can't see how you would do  
2 it.

3 MR. HACKETT: In addition to that, even if  
4 they are feasible, the last bullet, I think, applies.  
5 It's probably not going to be anything that is going  
6 to be impacting U.S. plants in the near term. It  
7 would require a longer term development effort.

8 Obviously, EDF and the French regulator  
9 concurred that they thought it was a workable  
10 situation for their plants. I think it would remain  
11 to be seen, and it would be the industry's decision  
12 whether to employ that sort of thing.

13 (Slide change)

14 MR. HACKETT: Cutting to structural margin  
15 and trying to get to this conclusion we have been  
16 talking about, a couple of things. The expert group,  
17 in addition to some of the staff, have basically  
18 verified the structural margin calculations by the  
19 industry, and that is to say Inconel 600 is a very  
20 flaw tolerant material, especially in the forged  
21 version.

22 It can tolerate very large through-wall  
23 circumferential cracks while still maintaining the  
24 structural margins. As pointed out earlier, the  
25 margin calculations don't really consider the crack

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1 growth or the time effect.

2 I think what, obviously, this is all  
3 crying out for in trying to integrate the conversation  
4 that was occurring previously is what is lacking from  
5 our side and the industry's side, I think, in a lot of  
6 cases, for lack of some appropriate data, is an  
7 integrated assessment of the structural integrity that  
8 would address the EAC.

9 Really, a lot of it is the linkage between  
10 the environmentally assisted cracking and the residual  
11 stress state that exists around the circumference of  
12 the penetrations, and also the inspections, what you  
13 can and can't do in terms of the future outages.

14 I think my own assessment of this, and I  
15 was glad to see that in the industry's response, is  
16 this really needs to be done in a probabilistic sense.  
17 I think the code they would likely use for this, also  
18 that the NRC has employed before, is PC PRAISE.

19 We employ a very similar methodology for  
20 accepting different phenomenon, and we've talked to  
21 the Committee before about pressurized thermal shock,  
22 and there we employ a probabilistic fracture mechanics  
23 assessment that uses the code FAVOR, which was  
24 developed at the Oak Ridge Laboratory.

25 That is really what needs to be done here,

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1 because you are dealing with an overwhelming number of  
2 variables to be assessed here. It has to be  
3 fundamentally done in a probabilistic sense that  
4 would, hopefully, get you at an initiating event  
5 frequency within some reasonable margin of  
6 uncertainty. That's where we are not right now.

7 I think, obviously, as Jack was  
8 indicating, the expectation on the part of the staff  
9 is that this thing is obviously not an event frequency  
10 of one. It is, hopefully, significantly less.

11 I think what we can't do is say we think  
12 it is this number as a median number with about this  
13 uncertainty band. So that is, hopefully, what we are  
14 driving toward.

15 DR. WALLIS; How do you get probabilistic  
16 information for this of aggressive chemical attack  
17 when you don't have any data?

18 MR. HACKETT: That is a real good  
19 question. I think, as you mentioned earlier, there  
20 are some assumptions you could make. I know some  
21 industry experts might be able to comment on this even  
22 more eloquently, but they employed a code previously  
23 in some evaluations for BWRs called VIPER, which did  
24 get into probabilistic aspects of the chemical species  
25 for BWRs.

1           So it can be done. Some assumptions have  
2 to be made. It's nicer still if you have the data.  
3 I think in the near term, we are obviously not going  
4 to have that data. So that will be one area where we  
5 will have to make some assumptions and then try and  
6 integrate this whole thing.

7           I guess that's what I would say in that  
8 regard.

9           (Slide change)

10          MR. HACKETT: Then in, I guess, sort of  
11 the summary -- and I guess I said a lot of this  
12 already. So what are we doing?

13          We are developing -- trying to develop  
14 this integrated perspective and, as Jack mentioned, a  
15 lot of this will rely on ongoing dialogue with the  
16 industry and consideration of the expert group reports  
17 and other analyses.

18          We are going to put this integrated -- the  
19 short term version, at any rate, the integrated  
20 perspective would be documented in a memorandum that  
21 we would be proposing right now would go from Jack  
22 Strosnider and Mike Mayfield, the two respective  
23 division directors in Offices of NRR and Research, to  
24 their office directors.

25          We will, hopefully -- I think more than

1 hopefully. We'd better have it done this month. I  
2 don't think we really have anymore time than that.  
3 That will be made public once we get that through  
4 concurrence.

5 What I would add, too, is that  
6 perspectives and recommendations from what I've been  
7 talking about here have been factored in, in an online  
8 sense, into what's gone into the generic  
9 communication.

10 The last bullet then: It is not  
11 anticipated that any further technical evaluation in  
12 the near term here would have a significant impact on  
13 the communication, but would, obviously, I think, in  
14 this case influence development of longer term  
15 programs for dealing with the issue.

16 I think I'll just conclude with that and  
17 see if there are any questions. If not, I'll turn it  
18 over to Tad.

19 DR. WALLIS: You talked about an  
20 integrated assessment of everything, the chemistry and  
21 the flow and everything. Will we ever see some kind  
22 of presentation on this, so that people understand it?

23 MR. HACKETT: I would hope so. I guess  
24 the timing is what is going to be key. I know Larry  
25 had indicated in his presentation that they were

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1 driving toward having a lot of this work done by, I  
2 think he said, end of the calendar year.

3 So somewhere -- It won't be within the  
4 next couple of months, I think, but maybe we would be  
5 looking at coming back before the Committee early 2002  
6 calendar year to be able to try and look back at this  
7 and here's the kind of integrated perspective we can  
8 bring to the thing, like we, hopefully, are able to do  
9 now with pressurized thermal shock, but hopefully, it  
10 won't take us as long, because PTS has been a long  
11 time in the coming. We will try and do it quicker  
12 this time.

13 CHAIRMAN FORD: Any other comments? Okay.  
14 Thanks, Ed. Thank you very much.

15 MR. MARSH: Mr. Chairman, I had a  
16 brilliant and highly informative presentation to make.

17 CHAIRMAN FORD: We have been allowed to go  
18 on until quarter to three, but I do want to spend a  
19 quarter of an hour in general discussion and getting  
20 some advice.

21 MR. MARSH: Okay. Well, let me proceed.  
22 My name is Tad Marsh, and I'm Chief of the --

23 CHAIRMAN FORD: If you could just try --

24 MR. MARSH: Five, ten minutes? Fine.

25 I'm Chief of the Operational Experience

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1 and Non-Power Reactors Branch, and I have the  
2 programmatic responsibility for generic  
3 communications.

4 (Slide change)

5 MR. MARSH: This part of the presentation  
6 today was meant to step back from the technical and  
7 talk about the process: Where are we in terms of  
8 generic communications?

9 I'm going to breeze through some of these  
10 slides pretty quickly. What I would like you to get  
11 from the first slide is that the agency made some  
12 substantive changes in the generic communication  
13 process in 1999, and there is a SECY paper, 99-143,  
14 which describes them.

15 Among the things that we did, we added  
16 more rigor into our process. We added some more  
17 vehicles, a regulatory issues summary, and we added  
18 some other features which I will ask you to go take a  
19 look at that SECY paper, if you would like.

20 (Slide change)

21 MR. MARSH: The next couple of slides talk  
22 about the vehicles themselves, bulletins and generic  
23 letters specifically, because those are the  
24 regulatory vehicles that require information back.

25 (Slide change)

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1 MR. MARSH: As a process matter, generic  
2 communications cannot require anything beyond  
3 responding. They cannot require a plant change. They  
4 can't require a plant shutdown. They can only require  
5 information back. They can request actions. They can  
6 request information, but they can only require  
7 responses back.

8 (Slide change)

9 MR. MARSH: If we were in the mode of  
10 requiring actions, we would be in the mode of a rule  
11 or an order, and we are not in that space. We are in  
12 the generic communication space. But it is important  
13 to note that, in terms of generic communications, this  
14 is the highest vehicle that we've got. A bulletin is  
15 the document that conveys the most significance. So  
16 from a perspective of significance, that is where we  
17 are.

18 (Slide change)

19 MR. MARSH: I'd like you to understand a  
20 little more about the differences between a generic  
21 letter and a bulletin, because the staff at one point  
22 was considering a generic letter. Since we were  
23 seeking information, another vehicle is to use a  
24 generic letter as opposed to a bulletin.

25 Setting aside that the bulletin conveys

1 more safety significance and more importance, which is  
2 the first major difference between the two, generic  
3 letters also take much more time.

4 This is a much more public part of the  
5 process. We put it out for public comment. We get  
6 comments back. We convey those comments up to the  
7 Commission. It's a much more protracted environment.

8 As a benchmark, bulletins should take on  
9 the order of eight to ten weeks, being as expedient as  
10 you can. There are ways to make that even shorter,  
11 but in order to go through all the hoops that you need  
12 to do, about eight to ten weeks for a bulletin.

13 A generic letter, on the other hand, can  
14 take five to six months and more, depending upon what  
15 happens, depending upon the comments that you get,  
16 depending upon the interactions with the Commission,  
17 etcetera.

18 So you can see an order of magnitude  
19 difference in terms of the documents and how long they  
20 take.

21 Another key ingredient in this process is  
22 that in a generic letter our procedure says the first  
23 thing you do after you get permission to proceed  
24 pursuing a safety matter is interact with the  
25 industry.

1                   Whatever venue that may take, whatever  
2 organization is that's responsible for this issue, you  
3 interact with them, the thrust being let's try to get  
4 a cooperative arrangement to solve the technical  
5 problem without relying on a generic communication or  
6 some sort. That's the first step, and that has taken  
7 place here.

8                   In fact, the staff has been working for  
9 roughly six months with the MRP on this issue,  
10 thinking that we would reach a resolution pathway. At  
11 some point, we diverted. We decided that we needed to  
12 take a regulatory action beyond relying on the  
13 industry for information.

14                   That occurred probably two months ago when  
15 we had several REIs. The questions and commitments  
16 and things were not reaching to a timely resolution.  
17 We went to a different track, a regulatory track, and  
18 the track demanded more action on our part. So that's  
19 the pathway that we are on.

20                   (Slide change)

21                   MR. MARSH: There is a diagram in the back  
22 which comes from the SECY paper which has that  
23 process, that generic communication process, working  
24 with the industry, etcetera. What it lacks in that  
25 diagram is feedback loops, because we did go from a

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1 generic letter route to a bulletin route.

2 Any questions before I launch on to what  
3 we have been doing? Okay.

4 (Slide change)

5 MR. MARSH: I am going to skip the next  
6 slide 5, which talks about requests for action,  
7 requests for information. If we had more time, I  
8 would like you to understand how we get to the various  
9 documents themselves.

10 I do want to talk about milestones,  
11 because the staff has been working aggressively with  
12 the industry in trying to come to resolution on these  
13 issues.

14 You've heard a lot of this, but this is,  
15 more or less, the sequence of steps that have been  
16 taken, interactions that have taken place. Key, I  
17 think, is many, many meetings, many public meetings  
18 with the MRP, and we are sensitive to that, because we  
19 have jumped over into a bulletin space, which is not  
20 as public a process as a generic letter. But we have  
21 had many public interactions, and I think those have  
22 worked.

23 We issued an information notice, which is  
24 another one of our regulatory vehicles, in April this  
25 year, and we conveyed results of the Oconee Unit 3

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1 results. We have had various REIs back and forth on  
2 trying to seek more information.

3 (Slide change)

4 MR. MARSH: On Slide 7 I would like you to  
5 see that we briefed the Commissioner of Technical  
6 Assistance two times. That is important, because we  
7 wanted to keep the Commission informed.

8 We indicated publicly in early June that  
9 we were headed toward a generic communication. In  
10 other words, we needed to take a more aggressive  
11 regulatory approach. We did that through a  
12 communication with NEI and through a public meeting  
13 and through meeting announcements. That occurred  
14 prior to the June 7th meeting.

15 That June 7th meeting, which was an  
16 important meeting, conveyed to the industry that we  
17 were concerned enough that we were headed for some  
18 type of communication. We were unsure what type at  
19 that point.

20 Then June 11: Ed has talked about the  
21 experts that have been convened through Research which  
22 were helping NRR in this regard. We have briefed CRGR  
23 once, July 2nd. That was a pre-brief. It is unsure  
24 whether we are going to have the formal brief, because  
25 they may be satisfied with the mark-up of the document

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1 coming from this discussion and coming from our own  
2 management discussions. So we believe we are in good  
3 shape with respect to the CRGR.

4 We also had a public meeting in July.

5 (Slide change)

6 MR. MARSH: Next and last slide talks  
7 about the steps that are in front of us. Today ACRS  
8 Subcommittee and tomorrow's full Committee meeting are  
9 key. As I say, we may have a CRGR meeting, a follow-  
10 on meeting, if they so choose.

11 We do seek a letter from you with any  
12 comments or suggestions that you may have, and we need  
13 CRGR endorsement. That is a requirement for a  
14 bulletin.

15 I should say you can not have CRGR  
16 endorsement, but it needs to be particularly urgent,  
17 and they ask that you come back to them following the  
18 issuance of a generic letter or a bulletin, if that's  
19 the route. In this case, we seek them in advance, and  
20 we have been keeping them informed.

21 We will be issuing a Commission  
22 information paper, and there is normally a ten-day  
23 time period where we wait for any comments they may  
24 have, and we will be issuing the bulletin, hopefully,  
25 by August 1st, which if you look at the agency's

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1 generic communication record lately, the last couple,  
2 three years, this is the first bulletin that we have  
3 issued since '97.

4           There's lots of reasons why that generic  
5 communications have dwindled in numbers, part of which  
6 we think the process has improved. But in terms of a  
7 time frame, I think eight weeks to ten weeks is the  
8 right time frame for something of this significance,  
9 and it speaks well, I think, for how we've been doing  
10 for addressing the issue.

11           That concludes my comments.

12           CHAIRMAN FORD: Tad, thank you very much  
13 indeed. I'd like to open up the meeting now for some  
14 general comments. Steve, you said you had some  
15 questions and comments.

16           MR. ROSEN: I have one. After listening  
17 to all this, it occurs to me that the aging management  
18 implications for plants that have applied for or  
19 indicated that they will apply for license renewal are  
20 important. What are your thoughts in that area?

21           MR. STROSNIDER: This is Jack Strosnider.  
22 I believe the Committee actually -- on one of the last  
23 licenses that was issued actually addressed this issue  
24 in their letter. If I can characterize the bottom  
25 line, it was this issue is going to have to be dealt

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1 with during the current licensing period, and whatever  
2 comes out of it that people would have to follow.

3           When you look at the time frame for when  
4 the renewed licenses actually go into effect, we  
5 expect that this issue has -- It has to be dealt with  
6 before that, and that was -- I want to be careful,  
7 because I don't want to put words in the mouth of the  
8 Committee, but that was my recollection of the  
9 message.

10           DR. BONACA: Our thought was there is no  
11 plan in place that we can put -- that will predict  
12 what may happen to some component, you know, 40 years  
13 of life. All we can expect, however, is that programs  
14 are in place that would provide inspections timely and  
15 be insightful enough to identify the gradient  
16 degradation mechanism and provide corrective actions.

17           MR. STROSNIDER: Let me add one thing to  
18 what I said earlier. You know, what we are talking  
19 about today with regard to this bulletin is really a  
20 one-time sort of a snapshot in time: Let's deal with  
21 the short term.

22           There is a recognition by the staff and by  
23 the industry that there needs to be a long term  
24 program put in place. In fact, the ASME code already  
25 has a group off looking at this, and we'll be pushing

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1 for some longer term augmented program that will  
2 address this. But when I say longer term, it's not  
3 that long. It's not all through license renewal  
4 period. It's much sooner than that.

5 CHAIRMAN FORD: Any other questions?

6 MR. SIEBER: General comment?

7 CHAIRMAN FORD: General comments, yes.

8 MR. SIEBER: I can offer a few things.  
9 First of all, I think that using the bulletin format  
10 was the way to go for this issue. So the choice is  
11 right, probably the simplest one, considering the fact  
12 that I think the issue is relatively urgent.

13 I concur with Dr. Wallis that there seems  
14 to be a lot of uncertainty in the machinations that  
15 were gone through to determine susceptibility ranking  
16 and phenomenologically describe actually what is going  
17 on.

18 So when I look at the data in view of my  
19 not very good feeling about the certainty of the  
20 rankings, I wonder why one would pick four years as a  
21 cutoff point for that second group of reactors rather  
22 than ten years. Seems to be a sort of a logical break  
23 point at ten years. That would pull in double the  
24 amount of plants in that period of time. So perhaps  
25 there is an answer to that.

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1 I think another question that comes up is  
2 the idea of collateral damage, if you would get a  
3 circumferential crack. It seems to me that since the  
4 CRDM housing is unsupported at one end, that crack  
5 when it got to 280-290 degrees, the remaining ligament  
6 would act like a hinge, and rather than just blow off,  
7 it would probably take the direction that the hinge  
8 would allow it to take. The only restraining thing  
9 would be the drive shaft that remains inside the tube.

10 So I think that's an issue that needs to  
11 be looked at as to whether that is likely and, if it  
12 is, would the adjacent rods have dropped prior to  
13 damage to any other housing. I sort of doubt that it  
14 would fracture another housing, but I'm not sure that  
15 it wouldn't bend on it.

16 So I think that that, to me, is a concern,  
17 and it's because of the geometry and the fact that  
18 it's not supported at one end. I've seen some  
19 circumferential cracks that finally broke in pipes  
20 that gave that hinge effect. It just sort of goes off  
21 to the side. So I think that that's an issue.

22 I would feel much more comfortable if a  
23 lot of these uncertainties and analyses that haven't  
24 been done were completed so that, even though the  
25 bulletin would go out, I think that we would profit

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1 from having more knowledge about probabilistic  
2 fracture mechanics and this geometry and what the  
3 spread of the data is and just exactly how well, with  
4 how much certainty, are all these factors established.

5 I think that that's a pretty good concern  
6 of mine. But otherwise, I think that, in light of  
7 what we know and what the industry has seen and  
8 reported, I think that the issuance of the bulletin is  
9 a good idea, and you've got to try to keep to your  
10 schedule.

11 One other comment. I'm familiar with weld  
12 repairs under Section 11. I wonder that, if you had  
13 a through-wall crack in a J-weld and you repair it by  
14 grinding it out and then doing -- you know, basically  
15 welding it back shut -- what do you do with all the  
16 boron crystals that are in this interference fit above  
17 it, and how does that affect the remaining life of  
18 whatever is in that nozzle area? Does that make the  
19 nozzle much more susceptible? Is there a way to clean  
20 it out, because you know it's going to be there?

21 DR. KRESS: Steam it.

22 MR. SIEBER: Well, you may get more steam  
23 than you want there, if you know what I mean. Anyway,  
24 that's a concern that I would have with weld repair  
25 under the code where you are, in effect, putting a

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1 canopy weld on with a long manufacturing crack right  
2 above it. So I don't know. Maybe somebody could  
3 answer that for me now or later.

4 Those would be my concerns.

5 CHAIRMAN FORD: Graham?

6 MR. LEITCH: I guess the acceptability of  
7 this whole approach, to me, seems to lie best on three  
8 principal legs. One is that the time-temperature  
9 relationship will identify susceptible plants, and I  
10 think, in spite of the uncertainties in that  
11 information, I think the fact that the plants -- that  
12 it would have identified the plants that actually have  
13 the cracks gives me some confidence there, although I  
14 don't know complete confidence. It does seem to be  
15 kind of the best that we could do at the moment, based  
16 on the data that is at hand.

17 The other major thing in my mind is that  
18 the boron crystals will be a telltale sign that we  
19 have a crack below that, as a visual examination  
20 looking for boron will tell us what we need to know.

21 I guess there I have a fair amount of  
22 confidence that even small leaks will, even through  
23 this interference fit, likely yield boron crystals  
24 that will be amenable to visual observation.

25 The third leg of the stool in my mind is

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1 that we understand crack growth rate. I guess there  
2 my confidence is least among these three areas. I  
3 just don't have a good feel that we really understand  
4 how fast these cracks can go.

5 I have had some experience that seems to  
6 suggest that the growth rate may not be linear. That  
7 is that the cracks may suddenly grow and then stop and  
8 then grow again and then stop, that there is some  
9 nonlinearity to this growth, particularly in an  
10 environment where we don't quite understand exactly  
11 what the environment is in this tight annulus or in  
12 these cracks.

13 So I guess, to sum up my comments, I would  
14 just say that I am most concerned about our  
15 understanding of crack growth rate and what that  
16 suggests for the frequency of inspections and future  
17 plans. But I think you are on the right path to  
18 accumulate that information and get as much data as we  
19 can and see where we go from there.

20 DR. KRESS: My view is very much like what  
21 Graham Leitch just expressed. I really think we can  
22 buy off on the susceptibility analysis, time and  
23 temperature.

24 I think it should be -- Some attempt  
25 should be made to look at the variability of the other

1 variables in there, the materials and the stress and  
2 so forth, to try to estimate the possible ranges of  
3 uncertainty in that. But I think that will probably  
4 be an acceptable way to determine the susceptibility  
5 and, therefore, to choose which plants to look at  
6 first.

7 I share Graham's view that the growth rate  
8 is of concern. There, I think you need to maybe  
9 utilize the early inspections of the plants in such a  
10 way that you can actually use it as data to determine  
11 that growth rate. Several inspections of a -- You  
12 know, when you find a crack in one of the plants like  
13 Oconee, do something about your inspection frequency  
14 to try to see if you can extract the growth rate out  
15 of that.

16 I think it would be useful to do some of  
17 Graham Wallis' analyses which are primarily thermal  
18 hydraulics to determine what the chemical environment  
19 is in that annulus and in the crack itself as a way to  
20 understand the growth rate or at least to have  
21 additional data at your fingertips.

22 So I would encourage you to try to do  
23 some. They are relatively simple. You know, it's not  
24 a big effort to do that particular calculation. So I  
25 think I would encourage that.

1 I think the inspection process could be  
2 thought of as a graded thing. As you do these early  
3 ones and you don't find much, you may want to relax  
4 how fast you do the others and which ones you draw in,  
5 but that's something you can decide later on after you  
6 see what you get with the first ones there.

7 I think you need to do some looking at  
8 validating the reactivity insertion effects that Mario  
9 brought up. I'm pretty sure that design basis  
10 reactivity insertion calculations that have usually  
11 been made in the first place are probably okay, and  
12 they tell you you are not going to exceed 10 CFR 100,  
13 and that should really be all NRC is concerned with.  
14 The utilities may be worried about more than that.

15 What bothers me there is I'm not sure it  
16 is just one rod, and I worried about the concept that  
17 Jack Sieber brought up about can we really be sure  
18 it's just one rod, and do those design basis analyses  
19 use the right energy level for the insertion? Do they  
20 rely on keeping below an energy level that you don't  
21 disperse the fuel and, if so, has that properly  
22 factored in the burnup effect that we have seen  
23 recently.

24 Maybe one needs to relook at that part of  
25 it when one looks at the reactivity insertion rate.

1 That's pretty much my comments.

2 CHAIRMAN FORD: Mario, do you have  
3 anything extra to say? Oh, I'm sorry, Steve. I'm  
4 sorry, I thought you had finished.

5 MR. ROSEN; No, I had one more point I  
6 would like to make, Peter.

7 My view is that regulatory compliance  
8 issues notwithstanding, I think the staff needs to put  
9 a high priority on the risk estimate. What they  
10 really need to do -- Tom was alluding to this -- is to  
11 track through with the best estimate way you can what  
12 would really happen if we had a full circumferential  
13 crack of one of these housings, so that we can really  
14 put this issue in context for ourselves, the industry  
15 and the public.

16 DR. BONACA: I can only second what I  
17 heard before. I agree with those points of view.  
18 Again, on the issue of rod ejection, I think, Tom, you  
19 expressed the whole thought of collateral damage here  
20 and the point that Jack took was very well described  
21 there. It is an issue that you have to look at, and  
22 just to have an appreciation for the potential issue  
23 of it. What is the whole separate issue?

24 The other issue that I think -- You know,  
25 in general when I look at the program presented here

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1 by the industry and by the NRC, I feel comfortable  
2 with that, with one exception. I mean, and I'm sure  
3 you share this, the effectiveness of the visual  
4 inspection. So I raised that issue before.

5 You are going to go there and look at  
6 these plants. The number of plants you are going to  
7 look at is a good number, is a solid number. It's in  
8 excess of 20, but you know, the only question is what  
9 are we going to learn from this?

10 You know, I didn't get out of this meeting  
11 with a warm feeling that, you know, we will look and  
12 find. I think in some cases we won't. So we are left  
13 still with that question of, you know, given the  
14 condition of the head and the insulation and so on and  
15 so forth, we'll have to learn how comfortable we can  
16 be.

17 DR. KRESS: I think we have to take  
18 comfort that Ocone didn't break before they saw  
19 something. It leaked before a break.

20 DR. BONACA: I agree. I agree with that.

21 DR. KRESS: And I think that is the  
22 comfort level you have to assume.

23 DR. BONACA: Yes. I'm only -- You know,  
24 we'll have to see in the next few months what we learn  
25 about the inspections and the visual and effectiveness

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1 of the visual inspections.

2 CHAIRMAN FORD: Bob?

3 DR. UHRIG: Well, I guess I have some  
4 concerns about the time-temperature model. My concern  
5 here is the fact that the three Oconee plants came out  
6 at the top of the list. Top priority may be  
7 fortuitous more than related to the model itself.

8 It reminds me a little bit of my graduate  
9 school days when they said you could fit any set of  
10 data with a straight line on log-log paper.

11 I am concerned here that this alignment of  
12 plants here -- and a little bit was expressed over  
13 here. Why not go out ten years, not four years. I  
14 think that whole group of high temperature plants, if  
15 you want to call them that, particularly the older  
16 ones, are prime candidates for inspection at the first  
17 opportunity.

18 Also one other last comment would be:  
19 There may be some foreign technology out there  
20 available in terms of sensors and ways of inspection  
21 that would be useful, and it ought to be looked at.

22 CHAIRMAN FORD: Thank you.

23 DR. WALLIS: Well, you have heard some of  
24 my concerns. There are really two things. One is  
25 knowing where we are, and then the other is knowing

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1 what to do.

2 In terms of knowing where we are, I feel  
3 that the risk analysis didn't tell us anything, and we  
4 really need to have some estimate of this 1-EF, even  
5 if it's difficult.

6 Of course, there are questions about the  
7 integration of the flows, the chemistry, the leaks,  
8 the cracks and so on. There's been too much emphasis  
9 on the crack. I think there's a whole lot of  
10 integrated phenomena going on here we've just begun to  
11 understand.

12 So knowing where we are is subject to a  
13 lot of uncertainties there. Of course, other  
14 questions have been raised, and my colleagues have  
15 raised them.

16 I guess what you are looking for is  
17 comments on whether the action proposed is  
18 appropriate, whether the bulletin is the right  
19 approach, whether what's in the bulletin is right.  
20 That would, I think, require a study that I haven't  
21 yet made of what actually is in the bulletin, and  
22 somehow trying to link that to what I think we know  
23 technically.

24 That's where personally I feel a little  
25 uncertain. I mean, I can comment technically about

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1 flows and chemistry and stuff, but then the regulatory  
2 environment for someone like me is always a somewhat  
3 arcane one, and whether or not this is appropriate  
4 regulatory action is difficult for me to assess. But  
5 I guess we have to do that, because that's the main  
6 question.

7           So I guess we will address that tomorrow  
8 unless we write a letter. I've got to somehow make  
9 the link between these technical things and what I  
10 think I know and think you don't know, and whether  
11 this is the appropriate thing to do in the near term  
12 and in the longer term. That's where I think we have  
13 some thinking to do.

14           CHAIRMAN FORD: I think, summarizing, as  
15 there are only three minutes to go: I think my advice  
16 for tomorrow is, bearing in mind that what we are  
17 going to try and convince the whole ACRS Committee,  
18 that what I think you are hoping for is a supportive  
19 letter to say the bulletin is the way to go, and I  
20 don't think there is going to be any argument that  
21 that is true.

22           There will be a whole lot of technical  
23 questions, and we will be all brought up very, very  
24 similar technical questions, in the short time  
25 available at the meeting tomorrow just to focus on

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1 those, and then heard about the inspection and how  
2 good is the inspection. Is visual inspections worth  
3 it? Obviously, it's one thing to do, but should we be  
4 putting efforts into other areas?

5 The question of crack growth rates: What  
6 the environment is, things of this nature. And then  
7 there's the risk assessment that came up. Are we  
8 absolutely sure that we should not be shutting the  
9 reactors down right now? I don't think that is the  
10 case. That's a worst case scenario.

11 Is the time-temperature histograms that  
12 we've been using -- is that an adequate way to  
13 prioritize inspections? That's the thing that needs  
14 to be addressed in a bit more detail, to the exclusion  
15 of some of the other things, given the short time that  
16 we have.

17 DR. KRESS: And Dana is -- we are sure  
18 going to ask his opinion.

19 CHAIRMAN FORD: About this question of the  
20 --

21 DR. KRESS: Maybe we want to be prepared  
22 to answer it.

23 CHAIRMAN FORD: There will be certainly a  
24 question from Dana Powers on the whole question of the  
25 SCRAM and --

1 DR. KRESS: Reactivity and failure to  
2 SCRAM.

3 MR. HACKETT: Failure to SCRAM in the  
4 LOCA, right?

5 CHAIRMAN FORD: That question, for sure,  
6 will come up. Are there any other last minute  
7 questions. Jack, do you have --

8 DR. WALLIS: I have another view, too.  
9 This is just today. This is an ongoing drama, and I  
10 expect that we will learn a lot in the next few  
11 months.

12 CHAIRMAN FORD: Oh, yes. You know, the  
13 thing that is really going to encourage me is the  
14 interaction between you and Research. They did not  
15 give me any forewarning as to the things they were  
16 going to talk about, and I find it very encouraging  
17 that you got a real good group of experts that are  
18 coming up with the answers.

19 I'm sorry. I'm talking to Jack there.  
20 You have heard all the questions, obviously. You can  
21 address this.

22 On that issue, Mag, how much time have  
23 they got? Do you know? Tomorrow?

24 MS. WESTON: Each group will have 15 to 20  
25 minutes only. The other amount of time should be

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1 reserved for discussion and additional questions that  
2 the Committee may have to wrap up the issue before  
3 they write the letter.

4 CHAIRMAN FORD: Okay. Are there any last  
5 minute comments, questions? Okay, thank you very  
6 much.

7 MR. HACKETT: Chairman Ford, if I could  
8 just a second -- Sorry about that.

9 There were just two I wanted to leave you  
10 guys with, because I think two very important comments  
11 were made, and one part I forgot to mention on the  
12 crack growth rates.

13 Several of you brought up crack growth  
14 rates. One of the things that would happen here,  
15 depending on the cracking phenomenology, if it goes  
16 through-wall preferentially going around the  
17 circumference, then you tend to move yourself back to  
18 a PWSCC environment because of the reservoir of the  
19 primary system.

20 Anyway, that's just something for folks to  
21 think about.

22 The last part was what Dr. Uhrig raised,  
23 and I could echo that. The Europeans, we believe, are  
24 probably significantly ahead on this issue in terms of  
25 inspection capabilities from some of what we have

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1 seen.

2 So there is some information to be gleaned  
3 out of that, too. Sorry about that.

4 CHAIRMAN FORD: Thanks very much.

5 (Whereupon, the foregoing matter went off  
6 the record at 2:47 p.m.)

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CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: ACRS Joint Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.



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